

# CONSTRUCTION DOCUMENTS

DSA App. #02-121994  
DSA File #34-53

## MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION

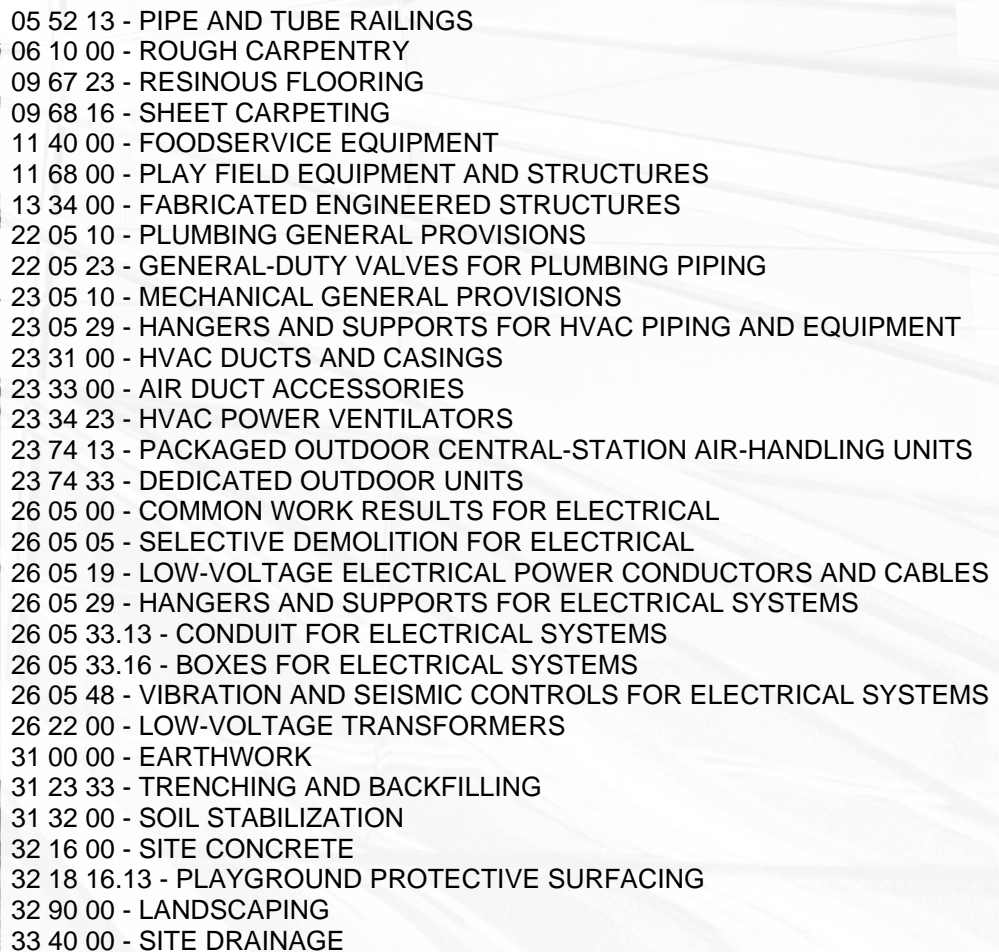
7680 Windbridge Dr., Sacramento, CA 95831

3186070

Sacramento City Unified School District

5735 47<sup>th</sup> Ave., Sacramento, CA 95824

### ADDENDUM #1 - REFER TO SECTIONS BELLOW FOR THE UPDATES



05 52 13 - PIPE AND TUBE RAILINGS  
06 10 00 - ROUGH CARPENTRY  
09 67 23 - RESINOUS FLOORING  
09 68 16 - SHEET CARPETING  
11 40 00 - FOODSERVICE EQUIPMENT  
11 68 00 - PLAY FIELD EQUIPMENT AND STRUCTURES  
13 34 00 - FABRICATED ENGINEERED STRUCTURES  
22 05 10 - PLUMBING GENERAL PROVISIONS  
22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING  
23 05 10 - MECHANICAL GENERAL PROVISIONS  
23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT  
23 31 00 - HVAC DUCTS AND CASINGS  
23 33 00 - AIR DUCT ACCESSORIES  
23 34 23 - HVAC POWER VENTILATORS  
23 74 13 - PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS  
23 74 33 - DEDICATED OUTDOOR UNITS  
26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL  
26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL  
26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS  
26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS  
26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS  
26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS  
26 22 00 - LOW-VOLTAGE TRANSFORMERS  
31 00 00 - EARTHWORK  
31 23 33 - TRENCHING AND BACKFILLING  
31 32 00 - SOIL STABILIZATION  
32 16 00 - SITE CONCRETE  
32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING  
32 90 00 - LANDSCAPING  
33 40 00 - SITE DRAINAGE

January 4, 2024

**MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT  
SACRAMENTO, CALIFORNIA**

January 4, 2024

HMC # 3186070

DSA App. #02-121994

DSA File #34-53

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HMC ARCHITECTS  
Architect

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RW Consulting Engineers, Inc.  
Structural Engineer

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LP Consulting Engineers, Inc.  
Mechanical/Plumbing Engineers

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LP Consulting Engineers, Inc.  
Electrical Engineer

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 07 - SIGNATURES

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00 - SUMMARY OF WORK  
01 21 00 - ALLOWANCE  
01 22 00 - ALTERNATES AND UNIT PRICING  
01 25 13 - PRODUCT OPTIONS AND SUBSTITUTIONS  
01 26 00 - CHANGES IN THE WORK  
01 29 00 - APPLICATION FOR PAYMENT  
01 31 19 - PROJECT MEETINGS  
01 32 13 - SCHEDULING OF WORK  
01 33 00 - SUBMITTALS  
01 35 13.23 - SITE STANDARDS  
01 41 00 - REGULATORY REQUIREMENTS  
01 42 13 - ABBREVIATIONS AND ACRONYMS  
01 42 16 - DEFINITIONS  
01 42 19 - REFERENCES  
01 43 00 - MATERIALS AND EQUIPMENT  
01 45 00 - QUALITY CONTROL  
01 50 00 - TEMPORARY FACILITIES AND CONTROLS  
01 50 13 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL  
01 56 39 - TEMPORARY TREE PROTECTION  
01 57 13 - EROSION CONTROL  
01 64 00 - OWNER-FURNISHED PRODUCTS  
01 66 00 - PRODUCT DELIVER, STORAGE AND HANDLING  
01 71 23 - FIELD ENGINEERING  
01 73 29 - CUTTING AND PATCHING  
01 76 00 - ALTERATION PROJECT PROCEDURES  
01 77 00 - CONTRACT CLOSEOUT AND FINAL CLEANING  
01 78 23 - OPERATION AND MAINTENANCE DATA  
01 78 36 - WARRANTIES  
01 78 39 - RECORD DOCUMENTS  
01 81 13.71 - SUSTAINABLE DESIGN REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL

DIVISION 02 - EXISTING CONDITIONS

02 41 19 - SELECTIVE DEMOLITION

DIVISION 03 - CONCRETE

03 30 53 - MISCELLANEOUS CAST-IN-PLACE CONCRETE  
03 35 03 - CONCRETE SLAB FINISHING

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Table of Contents  
TOC - 1

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

03 48 00 - PRECAST CONCRETE SPECIALTIES

DIVISION 04 - MASONRY

NOT APPLICABLE

DIVISION 05 - METALS

05 52 13 - PIPE AND TUBE RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00 - ROUGH CARPENTRY

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

NOT APPLICABLE

DIVISION 08 - OPENINGS

NOT APPLICABLE

DIVISION 09 - FINISHES

09 01 30.91 - TILE RESTORATION  
09 01 90.52 - MAINTENANCE REPAINTING  
09 51 13 - ACOUSTICAL PANEL CEILINGS  
09 65 00 - RESILIENT FLOORING  
09 65 13 - RESILIENT BASE AND ACCESSORIES  
09 67 23 - RESINOUS FLOORING  
09 68 13 - TILE CARPETING  
09 68 16 - SHEET CARPETING  
09 91 00 - PAINTING

DIVISION 10 - SPECIALTIES

10 14 00 - SIGNAGE  
10 26 00 - WALL AND DOOR PROTECTION  
10 28 00 - TOILET ACCESSORIES

DIVISION 11 - EQUIPMENT

11 40 00 - FOOD SERVICE EQUIPMENT  
11 61 43 - STAGE CURTAINS  
11 68 00 - PLAY FIELD EQUIPMENT AND STRUCTURES

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Table of Contents  
TOC - 2

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

DIVISION 12 - FURNISHINGS

12 24 13 - ROLLER WINDOW SHADES

DIVISION 13 - SPECIAL CONSTRUCTION

13 34 00 - FABRICATED ENGINEERED STRUCTURES

DIVISION 14 - CONVEYING EQUIPMENT

NOT APPLICABLE

DIVISION 21 - FIRE SUPPRESSION

NOT APPLICABLE

DIVISION 22 - PLUMBING

22 05 10 - PLUMBING GENERAL PROVISIONS  
22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING  
22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING  
22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT  
22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT  
22 07 19 - PLUMBING PIPING INSULATION  
22 10 05 - PLUMBING PIPING  
22 10 06 - PLUMBING PIPING SPECIALTIES  
22 30 00 - PLUMBING EQUIPMENT  
22 40 00 - PLUMBING FIXTURES

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING(HVAC)

23 05 10 - MECHANICAL GENERAL PROVISIONS  
23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT  
23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT  
23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC  
23 07 13 - DUCT INSULATION  
23 09 24 - DIRECT-DIGITAL CONTROL SYSTEMS FOR HVAC  
23 31 00 - HVAC DUCT AND CASINGS  
23 33 00 - AIR DUCT ACCESSORIES  
23 34 23 - HVAC POWER VENTILATORS  
23 74 13 - PACKAGED OUTDOOR CENTRAL-STATION AIR HANDLING UNITS  
23 74 33 - DEDICATED OUTDOOR AIR UNITS

DIVISION 25 - INTEGRATED AUTOMATION

NOT APPLICABLE

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Table of Contents  
TOC - 3

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

DIVISION 26 - ELECTRICAL

26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL  
26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL  
26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS  
26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS  
26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS  
26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS  
26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS  
26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS  
26 05 83 - WIRING CONNECTIONS  
26 08 00 - ELECTRICAL COMMISSIONING REQUIREMENTS  
26 09 23 - LIGHTING CONTROL DEVICES  
26 22 00 - LOW-VOLTAGE TRANSFORMERS  
26 24 16 - PANELBOARDS  
26 27 26 - WIRING DEVICES  
26 28 13 - FUSES  
26 28 16.13 - ENCLOSED CIRCUIT BREAKERS  
26 28 16.16 - ENCLOSED SWITCHES  
26 51 00 - INTERIOR LIGHTING  
26 26 00 - EXTERIOR LIGHTING

DIVISION 27 - COMMUNICATIONS

NOT APPLICABLE

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

NOT APPLICABLE

DIVISION 31 - EARTHWORK

31 00 00 - EARTHWORK  
31 23 33 - TRENCHING AND BACKFILLING  
31 32 00 - SOIL STABILIZATION

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 00 - ASPHALT CONCRETE PAVING  
32 16 00 - SITE CONCRETE  
32 17 25 - PAVEMENT COATINGS  
32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING  
32 18 23.39 - SYNTHETIC TRACK SURFACING  
32 80 00 - IRRIGATION  
32 90 00 - LANDSCAPING

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

DIVISION 33 - UTILITIES

33 40 00 - SITE DRAINAGE

DIVISION 34 - TRANSPORTATION

NOT APPLICABLE

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

NOT APPLICABLE

DIVISION 40 - PROCESS INTEGRATION

NOT APPLICABLE

DIVISION 41 - MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT APPLICABLE

DIVISION 42 - PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT APPLICABLE

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND  
STORAGE EQUIPMENT

NOT APPLICABLE

DIVISION 44 - POLLUTION CONTROL EQUIPMENT

NOT APPLICABLE

DIVISION 45 - INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT APPLICABLE

DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

NOT APPLICABLE

DIVISION 48 - ELECTRICAL POWER GENERATION

NOT APPLICABLE

DOCUMENT 00 01 10

**TABLE OF CONTENTS**



**General Requirements**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>    |
|-------------------|----------------|-----------------|
|                   | 01 11 00       | Summary of Work |

**Price and Payment Procedures**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>   |
|-------------------|----------------|--|
|                   | 01 21 00       | Allowance  |
|                   | 01 22 00       | Alternatives and Unit Prices   |
|                   | 01 25 13       | Product Options and Substitutions  |
|                   | 01 26 00       | Changes in the Work  |
|                   | 01 29 00       | Application for Payment and Conditional and Unconditional Waiver and Release Forms |

### **Administrative Requirements**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>       |
|-------------------|----------------|--------------------|
|                   | 01 31 19       | Project Meetings   |
|                   | 01 32 13       | Scheduling of Work |
|                   | 01 33 00       | Submittals         |
|                   | 01 35 13.23    | Site Standards     |

### **Quality Requirements**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>               |
|-------------------|----------------|----------------------------|
|                   | 01 41 00       | Regulatory Requirements    |
|                   | 01 42 13       | Abbreviations and Acronyms |
|                   | 01 42 16       | Definitions                |
|                   | 01 42 19       | References                 |
|                   | 01 43 00       | Materials and Equipment    |
|                   | 01 45 00       | Quality Control            |

### **Temporary Facilities and Controls**

| <u>Division 1</u> | <u>Section</u>      | <u>Title</u>                               |
|-------------------|---------------------|--|
|                   | 01 50 00            | Temporary Facilities and Controls          |
|                   | 01 50 13            | Construction Waste Management and Disposal |
|                   | <del>01 52 13</del> | <del>Field Offices</del>                   |
|                   | 01 56 39            | Temporary Tree Protection                  |
|                   | 01 57 13            | Erosion Control                            |

### **Product Requirements**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>                           |
|-------------------|----------------|--|
|                   | 01 64 00       | Owner-Furnished Products               |
|                   | 01 66 00       | Product Delivery, Storage and Handling |

### **Execution and Closeout Requirements**

| <u>Division 1</u> | <u>Section</u> | <u>Title</u>   |
|-------------------|----------------|--|
|                   | 01 71 23       | Field Engineering  |
|                   | 01 73 29       | Cutting and Patching                                       |
|                   | 01 76 00       | Alteration Project Procedures                              |
|                   | 01 77 00       | Contract Closeout and Final Cleaning                       |
|                   | 01 78 23       | Operation and Maintenance Data                             |
|                   | 01 78 36       | Warranties   |
|                   | 01 78 39       | Record Documents   |
|                   | 01 81 13.71    | Sustainable Design Requirements – CALGREEN Non-residential |

**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access Conditions and Requirements;
- B. Special Conditions.

**1.02 SUMMARY OF WORK COVERED BY CONTRACT DOCUMENTS**

- Modernization of the campus including replacement of playground structure for TK - K and higher-grade playgrounds
- Complete hardcourt resurfacing and stripping.
- Playfields renovation with running track
- Classroom signage upgrade package
- ADA accessibility upgrades for the classroom path of travel
- Partial HVAC replacement
- Campus wide exterior painting
- Campus wide interior painting
- Campus wide interior flooring upgrade

Additive Alternate #1 Kitchen with minor modernization

Included but not limited to:

1. Furnish and install all labor, material and equipment for all Work shown and/or specified in accordance with the Contract Documents, except as excluded below.
2. This scope of work Section 1.02 also applies to all applicable awarded alternates.
3. Information provided under "Also Included" points out some items which may be considered less obvious or "unconventional", but which are included in the Scope of Work.
4. This Bid Package Description is intended to clarify scope to the Contractor, but is in no way intended to limit scope that is reasonable

inferable as being required by the Work included in this description. Work required under the Bid Package may be shown as specified anywhere in the Contract Documents.

**Also Included but not limited to:**

1. Coordination with other Contractors working on this campus
2. Weather protection during the course of construction
3. Temporary barricades, signs, pedestrian protection, temporary facilities, and traffic control Work.
4. Daily and Final Clean-up.
5. Qualified/Certified Technicians must perform the replacement and/or repair of all landscape, irrigation asphalt/concrete surfaces and above or below grade utilities disturbed during construction, and the District must be given the opportunity to test and accept the Work prior to covering it up.
6. Patching, repairing, painting and/or replacement of all finished surfaces disturbed during construction.
7. Provide temporary means of operation for existing storm, water, sewer, gas, mechanical, electrical, and low voltage systems during construction.
8. Perform an electronic underground existing utility survey by a qualified underground utility locator service company in all areas where trenching operations will be performed. An as-built record drawing (one hard copy and one copy on electronic media prepared in AutoCAD is required to be submitted at the conclusion of the underground scope of Work.
9. Contractor to perform ball/flush/camera of all affected sanitary sewer and/or storm drains prior to and post construction. Video shall be turned over to the District and should include audio and locations.
10. Any campus utility interruptions require a minimum of a 48-hour notice to the District Representative for coordination purposes.
11. A full-time superintendent shall be provided.
12. All demolition and removal and/or replacement of Work associated with this Bid Package.
13. Contractor to provide its own water for its grading activities. Onsite water (hose bibs) will not be sufficient for grading activities.

**1.03 CONTRACTS**

- A. Perform the Work under a single, fixed-price Contract.

**1.04 WORK BY OTHERS**

- A. Work on the Project that will be performed and completed prior to the start of the Work of this Contract.

- B. Work on the Project that will be performed by others concurrent with the Work of this Contract.

### **1.05 CODES, REGULATIONS, AND STANDARDS**

- A. The codes, regulations, and standards adopted by the state and federal agencies having jurisdiction shall govern minimum requirements for this Project. Where codes, regulations, and standards conflict with the Contract Documents, these conflicts shall be brought to the immediate attention of the District and the Architect.
- B. Codes, regulations, and standards shall be as published effective as of date of bid opening, unless otherwise specified or indicated.

### **1.06 PROJECT RECORD DOCUMENTS**

- A. Contractor shall maintain on Site one set of the following record documents; Contractor shall record actual revisions to the Work:
  - (1) Contract Drawings.
  - (2) Specifications.
  - (3) Addenda.
  - (4) Change Orders and other modifications to the Contract.
  - (5) Reviewed shop drawings, product data, and samples.
  - (6) Field test records.
  - (7) Inspection certificates.
  - (8) Manufacturer's certificates.
- B. Contractor shall store Record Documents separate from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.
- C. Contractor shall record information concurrent with construction progress.
- D. Specifications: Contractor shall legibly mark and record at each product section of the Specifications the description of the actual product(s) installed, including the following:
  - (1) Manufacturer's name and product model and number.
  - (2) Product substitutions or alternates utilized.
  - (3) Changes made by Addenda and Change Orders and written directives.

### **1.07 EXAMINATION OF EXISTING CONDITIONS**

- A. Contractor shall be held to have examined the Project Site and acquainted itself with the conditions of the Site and of the streets or roads approaching the Site.
- B. Prior to commencement of Work, Contractor shall survey the Site and existing buildings and improvements to observe existing damage and defects such as cracks, sags, broken, missing or damaged glazing, other building elements and Site improvements, and other damage.
- C. Should Contractor observe cracks, sags, and other damage to and defects of the Site and adjacent buildings, paving, and other items not indicated in the Contract Documents, Contractor shall immediately report same to the District and the Architect.

### **1.08 CONTRACTOR'S USE OF PREMISES**

- A. If unoccupied and only with District's prior written approval, Contractor may use the building(s) at the Project Site without limitation for its operations, storage, and office facilities for the performance of the Work. If the District chooses to beneficially occupy any building(s), Contractor must obtain the District's written approval for Contractor's use of spaces and types of operations to be performed within the building(s) while so occupied. Contractor's access to the building(s) shall be limited to the areas indicated.
- B. If the space at the Project Site is not sufficient for Contractor's operations, storage, office facilities and/or parking, Contractor shall arrange and pay for any additional facilities needed by Contractor.
- C. Contractor shall not interfere with use of or access to occupied portions of the building(s) or adjacent property.
- D. Contractor shall maintain corridors, stairs, halls, and other exit-ways of building clear and free of debris and obstructions at all times.
- E. No one other than those directly involved in the demolition and construction, or specifically designated by the District or the Architect shall be permitted in the areas of work during demolition and construction activities.
- F. The Contractor shall install the construction fence and maintain that it will be locked when not in use. Keys to this fencing will be provided to the District.

### **1.09 PROTECTION OF EXISTING STRUCTURES AND UTILITIES**

- A. The Drawings show above-grade and below-grade structures, utility lines, and other installations that are known or believed to exist in the area of the Work. Contractor shall locate these existing installations before proceeding with excavation and other operations that could damage same; maintain them in service, where appropriate; and repair damage to them caused by the performance of the Work. Should damage occur to these existing

installations, the costs of repair shall be at the Contractor's expense and made to the District's satisfaction.

- B. Contractor shall be alert to the possibility of the existence of additional structures and utilities. If Contractor encounters additional structures and utilities, Contractor will immediately report to the District for disposition of same as indicated in the General Conditions.

#### **1.10 UTILITY SHUTDOWNS AND INTERRUPTIONS**

- A. Contractor shall give the District a minimum of three (3) days written notice in advance of any need to shut off existing utility services or to effect equipment interruptions. The District will set exact time and duration for shutdown, and will assist Contractor with shutdown. Work required to re-establish utility services shall be performed by the Contractor.
- B. Contractor shall obtain District's written approval as indicated in the General Conditions in advance of deliveries of material or equipment or other activities that may conflict with District's use of the building(s) or adjacent facilities.

#### **1.11 STRUCTURAL INTEGRITY**

- A. Contractor shall be responsible for and supervise each operation and work that could affect structural integrity of various building elements, both permanent and temporary.
- B. Contractor shall include structural connections and fastenings as indicated or required for complete performance of the Work.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**ALLOWANCE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

A. Non-specified work.

**1.2 RELATED SECTIONS**

A. Document 01 10 00 (Summary of Work)

B. Document 01 29 00 (Payments and Completion)

C. Document 01 32 19 (Submittal Procedures)

**1.3 ALLOWANCES**

A. Included in the Contract, a stipulated sum/price of **\$600,000.00**.

As Owner allowances within the limits set forth in the Contract Documents. These Allowance(s) shall not be utilized without written approval by the District.

B. Contractor's costs, without overhead and profit, for products, delivery, installation, labor, insurance, payroll, taxes, bonding and equipment rental will be included in Allowance Expenditure Directive authorizing expenditure of funds from this Allowance. No overhead and profit shall be added to the Allowance Expenditure Directive.

C. Funds will be drawn from Allowance only with District approval evidenced by an Allowance Expenditure Directive.

D. At Contract closeout, funds remaining in Allowance will be credited to District by Change Order.

E. Whenever costs are more than the Allowance, the amount covered by the Allowance will be approved at cost. The Contract Price shall be adjusted by Change Order for amounts in excess of the Allowance.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

END OF DOCUMENT



**ALTERNATES AND UNIT PRICING**

**PART 1 – ALTERNATES**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Bid Form and Proposal;
- D. Instruction to Bidders.

**1.02 DESCRIPTION**

The items of work indicated below propose modifications to, substitutions for, additions to and/or deletions from the various parts of the Work specified in other Sections of the Specifications. The acceptance or rejection of any of the alternates is strictly at the option of the District subject to District's acceptance of Contractor's stated prices contained in this Proposal.

**1.03 GENERAL**

Where an item is omitted, or scope of Work is decreased, all Work pertaining to the item whether specifically stated or not, shall be omitted and where an item is added or modified or where scope of Work is increased, all Work pertaining to that required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

**1.04 BASE BID**

The Base Bid includes all work required to construct the Project completely and in accordance with the Contract Documents.

**1.05 ALTERNATES**

The above Alternate descriptions are general in nature and for reference purposes only. The Contract Documents, including, without limitation, the Drawings and Specifications, must be referred to for the complete scope of Work.

## **PART 2 - UNIT PRICING (NOT USED)**

### **2.01 GENERAL**

Contractor shall completely state all required figures based on Unit Prices listed below. Where scope of Work is decreased, all Work pertaining to the item, whether specifically stated or not, shall be omitted and where scope of Work is increased, all work pertaining to that item required to render same ready for use on the Project in accordance with intention of Drawings and Specifications shall be included in an agreed upon price amount.

### **2.02 UNIT PRICES**

Furnish unit prices for each of the named items on a square foot, lineal foot, or per each basis, as applies. Unit prices shall include all labor, materials, services, profit, overhead, insurance, bonds, taxes, and all other incidental costs of Contractor, subcontractors, and supplier(s).

END OF DOCUMENT

**PRODUCT OPTIONS AND SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. Instructions to Bidders;
- B. General Conditions, including, without limitation, Substitutions For Specified Items; and
- C. Special Conditions.

**1.02 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT**

- A. Catalog numbers and specific brands or trade names followed by the designation "or equal" are used in conjunction with material and equipment required by the Specifications to establish the standards of quality, utility, and appearance required. Substitutions which are equal in quality, utility, and appearance to those specified may be reviewed subject to the provisions of the General Conditions.
- B. Wherever more than one manufacturer's product is specified, the first-named product is the basis for the design used in the work and the use of alternative-named manufacturers' products or substitutes may require modifications in that design. If such alternatives are proposed by Contractor and are approved by the District and/or the Architect, Contractor shall assume all costs required to make necessary revisions and modifications of the design resulting from the substitutions requested by the Contractor.
- C. When materials and equipment are specified by first manufacturer's name and product number, second manufacturer's name and "or approved equal," supporting data for the second product, if proposed by Contractor, shall be submitted in accordance with the requirements for substitutions. The District's Board has found and determined that certain item(s) shall be used on this Project based on the purpose(s) indicated pursuant to Public Contract Code section 3400(c). These findings, as well as the products and brand or trade names, have been identified in the Notice to Bidders.
- D. The Contractor will not be allowed to substitute specified items unless the request for substitution is submitted as follows:
  - (1) District must receive any notice of request for substitution of a specified item a minimum of ten (10) calendar days prior to bid opening.

- (2) Within 35 days after the date of the Notice of Award, the Contractor shall submit data substantiating the request(s) for all substitution(s) containing sufficient information to assess acceptability of product or system and impact on Project, including, without limitation, the requirements specified in the Special Conditions and the technical Specifications. Insufficient information shall be grounds for rejection of substitution.
- E. If the District and/or Architect, in reviewing proposed substitute materials and equipment, require revisions or corrections to be made to previously accepted Shop Drawings and supplemental supporting data to be resubmitted, Contractor shall promptly do so. If any proposed substitution is judged by the District and/or Architect to be unacceptable, the specified material or equipment shall be provided.
- F. Samples may be required. Tests required by the District and/or Architect for the determination of quality and utility shall be made at the expense of Contractor, with acceptance of the test procedure first given by the District.
- G. In reviewing the supporting data submitted for substitutions, the District and/or Architect will use for purposes of comparison all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Contract Documents. If more than two (2) submissions of supporting data are required, the cost of reviewing the additional supporting data shall be borne by Contractor, and the District will deduct the costs from the Contract Price. The Contractor shall be responsible for any re-design costs occasioned by District's acceptance and/or approval of any substitute.
- H. The Contractor shall, in the event that a substitute is less costly than that specified, credit the District with one hundred percent (100%) of the net difference between the substitute and the originally specified material. In this event, the Contractor agrees to execute a deductive Change Order to reflect that credit. In the event Contractor furnishes a material, process, or article more expensive than that specified, the difference in the cost of that material, process, or article so furnished shall be borne by Contractor.
- I. In no event shall the District be liable for any increase in Contract Price or Contract Time due to any claimed delay in the evaluation of any proposed substitute or in the acceptance or rejection of any proposed substitute.
- J. All Substitutions affecting DSA regulated items, or related to DSA SSS, ACS, and FLS items shall be considered as a CCD or Addenda and shall be submitted to and approved by DSA prior to installation and/or fabrication, per CCR 4-338(c) and IR 4-6. Any cost changes associated with this work during construction shall be at the contractor's expense.

**PART 2 – PRODUCTS Not used**  
**PART 3 – EXECUTION Not used**

END OF DOCUMENT

DOCUMENT 01 26 00

**CHANGES IN THE WORK**

**CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE PROVISIONS IN THE AGREEMENT, GENERAL CONDITIONS, AND SPECIAL CONDITIONS, IF USED, RELATED TO CHANGES AND/OR REQUESTS FOR CHANGES.**

END OF DOCUMENT

DOCUMENT 01 29 00

**APPLICATION FOR PAYMENT AND  
CONDITIONAL AND UNCONDITIONAL WAIVER AND RELEASE FORMS**

**CONTRACTOR SHALL COMPLY WITH ALL PROVISIONS IN THE GENERAL  
CONDITIONS RELATED TO APPLICATIONS FOR PAYMENT AND/OR  
PAYMENTS.**

**SACRAMENTO CITY USD  
Matsuyama Elementary School Campus  
Renewal**

**APPLICATION FOR PAYMENT AND  
CONDITIONAL AND UNCONDITIONAL  
WAIVER AND RELEASE FORMS  
DOCUMENT 01 29 00-1**

**CONDITIONAL WAIVER AND RELEASE  
ON PROGRESS PAYMENT  
(CIVIL CODE SECTION 8132)**

NOTICE: THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Name of Claimant: \_\_\_\_\_

Name of Customer: \_\_\_\_\_

Job Location: \_\_\_\_\_

Owner: \_\_\_\_\_

Through Date: \_\_\_\_\_

**Conditional Waiver and Release**

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: \_\_\_\_\_

Amount of Check: \$ \_\_\_\_\_

Check Payable to: \_\_\_\_\_

**Exceptions**

This document does not affect any of the following:

- (1) Retentions.
- (2) Extras for which the claimant has not received payment.
- (3) The following progress payments for which the claimant has previously given a conditional waiver and release but has not received payment:

Date(s) of waiver and release: \_\_\_\_\_

Amount(s) of unpaid progress payment(s): \$ \_\_\_\_\_

**SACRAMENTO CITY USD  
Matsuyama Elementary School Campus  
Renewal**

**APPLICATION FOR PAYMENT AND  
CONDITIONAL AND UNCONDITIONAL  
WAIVER AND RELEASE FORMS  
DOCUMENT 01 29 00-2**

- (4) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Claimant's Signature: \_\_\_\_\_

Claimant's Title: \_\_\_\_\_

Date of Signature: \_\_\_\_\_



**UNCONDITIONAL WAIVER AND RELEASE  
ON PROGRESS PAYMENT  
(CIVIL CODE SECTION 8134)**

NOTICE TO CLAIMANT: THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Name of Claimant: \_\_\_\_\_

Name of Customer: \_\_\_\_\_

Job Location: \_\_\_\_\_

Owner: \_\_\_\_\_

Through Date: \_\_\_\_\_

**Unconditional Waiver and Release**

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job through the Through Date of this document. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has received the following progress payment: \$\_\_\_\_\_

**Exceptions**

This document does not affect any of the following:

- (5) Retentions.
- (6) Extras for which the claimant has not received payment.
- (7) Contract rights, including (A) a right based on rescission, abandonment, or breach of contract, and (B) the right to recover compensation for work not compensated by the payment.

Claimant's Signature: \_\_\_\_\_

Claimant's Title: \_\_\_\_\_

Date of Signature: \_\_\_\_\_

**CONDITIONAL WAIVER AND RELEASE  
ON FINAL PAYMENT  
(CIVIL CODE SECTION 8136)**

**NOTICE:** THIS DOCUMENT WAIVES THE CLAIMANT'S LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS EFFECTIVE ON RECEIPT OF PAYMENT. A PERSON SHOULD NOT RELY ON THIS DOCUMENT UNLESS SATISFIED THAT THE CLAIMANT HAS RECEIVED PAYMENT.

Name of Claimant: \_\_\_\_\_

Name of Customer: \_\_\_\_\_

Job Location: \_\_\_\_\_

Owner: \_\_\_\_\_

**Conditional Waiver and Release**

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. This document is effective only on the claimant's receipt of payment from the financial institution on which the following check is drawn:

Maker of Check: \_\_\_\_\_

Amount of Check: \$ \_\_\_\_\_

Check Payable to: \_\_\_\_\_

**Exceptions**

This document does not affect any of the following: \_\_\_\_\_

Disputed claims for extras in the amount of: \$ \_\_\_\_\_

Claimant's Signature: \_\_\_\_\_

Claimant's Title: \_\_\_\_\_

Date of Signature: \_\_\_\_\_

**UNCONDITIONAL WAIVER AND RELEASE  
ON FINAL PAYMENT  
(CIVIL CODE SECTION 8138)**

**NOTICE TO CLAIMANT:** THIS DOCUMENT WAIVES AND RELEASES LIEN, STOP PAYMENT NOTICE, AND PAYMENT BOND RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL WAIVER AND RELEASE FORM.

Name of Claimant: \_\_\_\_\_

Name of Customer: \_\_\_\_\_

Job Location: \_\_\_\_\_

Owner: \_\_\_\_\_

**Unconditional Waiver and Release**

This document waives and releases lien, stop payment notice, and payment bond rights the claimant has for all labor and service provided, and equipment and material delivered, to the customer on this job. Rights based upon labor or service provided, or equipment or material delivered, pursuant to a written change order that has been fully executed by the parties prior to the date that this document is signed by the claimant, are waived and released by this document, unless listed as an Exception below. The claimant has been paid in full.

**Exceptions**

This document does not affect any of the following: \_\_\_\_\_

Disputed claims for extras in the amount of: \$\_\_\_\_\_

Claimant's Signature: \_\_\_\_\_

Claimant's Title: \_\_\_\_\_

Date of Signature: \_\_\_\_\_

**PROJECT MEETINGS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions; and
- B. Special Conditions.

**1.02 PROGRESS MEETINGS:**

- A. The District Representative shall schedule and hold regular weekly progress meetings after a minimum of one week's prior written notice of the meeting date and time to all Invitees as indicated below.
- B. Location: TBD
- C. The District Representative shall notify and invite the following entities ("Invitees"):
  - (1) District Representative.
  - (2) Contractor.
  - (3) Contractor's Project Manager.
  - (4) Contractor's Superintendent.
  - (5) Subcontractors, as appropriate to the agenda of the meeting.
  - (6) Suppliers, as appropriate to the agenda of the meeting.
  - (7) Architect
  - (8) Engineer(s), if any and as appropriate to the agenda of the meeting.
  - (9) Others, as appropriate to the agenda of the meeting.
- D. The District's and/or the Architect's Consultants will attend at their discretion, in response to the agenda.
- E. The District representative, the Construction Manager, and/or another District Agent shall take and distribute meeting notes to attendees and other concerned parties. If exceptions are taken to anything in the meeting notes,

those exceptions shall be stated in writing to the District within five (5) working days following District's distribution of the meeting notes.

**1.03 PRE-INSTALLATION/PERFORMANCE MEETING:**

- A. Contractor shall schedule a meeting prior to the start of each of the following portions of the Work: n/a Contractor shall invite all Invitees to this meeting, and others whose work may affect or be affected by the quality of the cutting and patching work.
- B. Contractor shall review in detail prior to this meeting, the manufacturer's requirements and specifications, applicable portions of the Contract Documents, Shop Drawings, and other submittals, and other related work. At this meeting, invitees shall review and resolve conflicts, incompatibilities, or inadequacies discovered or anticipated.
- C. Contractor shall review in detail Project conditions, schedule, requirements for performance, application, installation, and quality of completed Work, and protection of adjacent Work and property.
- D. Contractor shall review in detail means of protecting the completed Work during the remainder of the construction period.

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**SCHEDULING OF WORK**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Summary of Work; and
- D. Submittals.

**1.02 SECTION INCLUDES**

- A. Scheduling of Work under this Contract shall be performed by Contractor in accordance with requirements of this Section.
  - (1) Development of schedule, cost and resource loading of the schedule, monthly payment requests, and project status reporting requirements of the Contract shall employ computerized Critical Path Method ("CPM") scheduling ("CPM Schedule").
  - (2) CPM Schedule shall be cost loaded based on Schedule of Values as approved by District.
  - (3) Submit schedules and reports as specified in the General Conditions.
- B. Upon Award of Contract, Contractor shall immediately commence development of Initial and Original CPM Schedules to ensure compliance with CPM Schedule submittal requirements.

**1.03 CONSTRUCTION SCHEDULE**

- A. Within ten (10) days of issuance of the Notice of Intent to Award and before request for first progress payment, the Contractor shall prepare and submit to the Project Manager a construction progress schedule conforming to the Milestone Schedule below.
- B. The Construction Schedule shall be continuously updated, and an updated schedule shall be submitted with each application for progress payment. Each revised schedule shall indicate the work actually accomplished during the previous period and the schedule for completion of the remaining work.

C. Milestone Schedule:

**Preliminary Construction Schedule**

Missing established milestones subjects the Contractor to liquidated damages.

| ID | Task Name                          | Duration        | Start               | Finish              | 2024    |   | 2025 |   |   |   |   |   |   |   |   |   |   |
|----|------------------------------------|-----------------|---------------------|---------------------|---------|---|------|---|---|---|---|---|---|---|---|---|---|
|    |                                    |                 |                     |                     | D       | J | F    | M | A | M | J | J | A | S | O | N | D |
| 1  | <b>Matsuyama ES MOD</b>            | <b>257 days</b> | <b>Fri 1/5/24</b>   | <b>Mon 12/30/24</b> |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 2  | DSA Submittal                      | 0 days          | Fri 1/5/24          | Fri 1/5/24          | ◆ 1/5   |   |      |   |   |   |   |   |   |   |   |   |   |
| 3  | DSA Review                         | 10 wks          | Mon 1/8/24          | Fri 3/15/24         |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 4  | DSA Back-check                     | 2 wks           | Mon 3/11/24         | Fri 3/22/24         |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 5  | DSA Approval                       | 0 days          | Fri 3/29/24         | Fri 3/29/24         | ◆ 3/29  |   |      |   |   |   |   |   |   |   |   |   |   |
| 6  | <b>Bid/Award</b>                   | <b>52 days</b>  | <b>Wed 2/14/24</b>  | <b>Thu 4/25/24</b>  |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 7  | Advertise                          | 0 days          | Wed 2/14/24         | Wed 2/14/24         | ◆ 2/14  |   |      |   |   |   |   |   |   |   |   |   |   |
| 8  | Advertise 2                        | 0 days          | Wed 2/21/24         | Wed 2/21/24         | ◆ 2/21  |   |      |   |   |   |   |   |   |   |   |   |   |
| 9  | Mandatory Pre-bid @ 3pm            | 0 days          | Thu 2/22/24         | Thu 2/22/24         | ◆ 2/22  |   |      |   |   |   |   |   |   |   |   |   |   |
| 10 | Bidder RFIs due by 10am            | 0 days          | Tue 2/27/24         | Tue 2/27/24         | ◆ 2/27  |   |      |   |   |   |   |   |   |   |   |   |   |
| 11 | Issue Addenda by 10am              | 0 days          | Tue 3/5/24          | Tue 3/5/24          | ◆ 3/5   |   |      |   |   |   |   |   |   |   |   |   |   |
| 12 | Bids due by 10am                   | 0 days          | Fri 3/8/24          | Fri 3/8/24          | ◆ 3/8   |   |      |   |   |   |   |   |   |   |   |   |   |
| 13 | Issue Notice of Intent             | 5 days          | Thu 3/14/24         | Wed 3/20/24         |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 14 | Anticipated Board Approval         | 0 days          | Thu 4/18/24         | Thu 4/18/24         | ◆ 4/18  |   |      |   |   |   |   |   |   |   |   |   |   |
| 15 | Issue NTP                          | 0 days          | Mon 4/22/24         | Mon 4/22/24         | ◆ 4/22  |   |      |   |   |   |   |   |   |   |   |   |   |
| 16 | <b>Construction</b>                | <b>171 days</b> | <b>Mon 5/6/24</b>   | <b>Mon 12/30/24</b> |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 17 | Mobilize                           | 0 days          | Mon 5/6/24          | Mon 5/6/24          | ◆ 5/6   |   |      |   |   |   |   |   |   |   |   |   |   |
| 18 | Construction                       | 4 mons          | Mon 5/6/24          | Fri 8/23/24         |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 19 | Kitchen health department approval | 0 days          | Mon 8/26/24         | Mon 8/26/24         | ◆ 8/26  |   |      |   |   |   |   |   |   |   |   |   |   |
| 20 | Punchlist                          | 2 mons          | Tue 8/27/24         | Mon 10/21/24        |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 21 | Landscape Maintenance Period       | 90 days         | Tue 8/27/24         | Mon 12/30/24        |         |   |      |   |   |   |   |   |   |   |   |   |   |
| 22 | <b>Closeout</b>                    | <b>0 mons</b>   | <b>Mon 12/30/24</b> | <b>Mon 12/30/24</b> | ◆ 12/30 |   |      |   |   |   |   |   |   |   |   |   |   |

**1.04 QUALIFICATIONS**

- A. Contractor shall employ experienced scheduling personnel qualified to use the latest version of Microsoft Project. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose.
- (1) The written statement shall identify the individual who will perform CPM scheduling.
  - (2) Capability and experience shall be verified by description of construction projects on which individual has successfully applied computerized CPM.
  - (3) Required level of experience shall include at least two (2) projects of similar nature and scope with value not less than three fourths (¾) of the Total Bid Price of this Project. The written statement shall provide contact persons for referenced projects with current telephone and address information.

- B. District reserves the right to approve or reject Contractor's scheduler or consultant at any time. District reserves the right to refuse replacing of Contractor's scheduler or consultant, if District believes replacement will negatively affect the scheduling of Work under this Contract.

#### **1.05 GENERAL**

- A. Progress Schedule shall be based on and incorporate milestone and completion dates specified in Contract Documents.
- B. Overall time of completion and time of completion for each milestone shown on Progress Schedule shall adhere to times in the Contract, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by District. Any such agreement shall be formalized by a Change Order.
  - (1) District is not required to accept an early completion schedule, i.e., one that shows an earlier completion date than the Contract Time.
  - (2) Contractor shall not be entitled to extra compensation in event agreement is reached on an earlier completion schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in its early completion schedule but within the Contract Time.
  - (3) A schedule showing the work completed in less than the Contract Time, and that has been accepted by District, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the work and the Completion Date. Project Float is a resource available to both District and the Contractor.
- C. Ownership Project Float: Neither the District nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of the Completion Date rests with the party whose actions, last in time, actually cause delay to the Completion Date.
  - (1) For example, if Party A uses some, but not all of the Project Float and Party B later uses remainder of the Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Completion Date.
  - (2) Party A would not be responsible for the time since it did not consume the entire Project Float and additional Project Float remained; therefore, the Completion Date was unaffected by Party A.
- D. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract CPM Schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.
- E. Failure of Progress Schedule to include any element of the Work, or any inaccuracy in Progress Schedule, will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. District's



acceptance of schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests and shall not, in any manner, impose a duty of care upon District, or act to relieve Contractor of its responsibility for means and methods of construction.

- F. Software: Use **District Preferred Project Planning Software**. Such software shall be compatible with Windows operating system. Contractor shall transmit contract file to District on compact disk at times requested by District.
- G. Transmit each item under the form approved by District.
  - (1) Identify Project with District Contract number and name of Contractor.
  - (2) Provide space for Contractor's approval stamp and District's review stamps.
  - (3) Submittals received from sources other than Contractor will be returned to the Contractor without District's review.

#### **1.06 INITIAL CPM SCHEDULE**

- A. Initial CPM Schedule submitted for review at the pre-construction conference shall serve as Contractor's schedule for up to ninety (90) calendar days after the Notice to Proceed.
- B. Indicate detailed plan for the Work to be completed in first ninety (90) days of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; procurement of materials and equipment. Show Work beyond ninety (90) calendar days in summary form.
- C. Initial CPM Schedule shall be time scaled.
- D. Initial CPM Schedule shall be cost and resource loaded. Accepted cost and resource loaded schedule will be used as basis for monthly progress payments until acceptance of the Original CPM Schedule. Use of Initial CPM Schedule for progress payments shall not exceed ninety (90) calendar days.
- E. District and Contractor shall meet to review and discuss the Initial CPM Schedule within seven (7) calendar days after it has been submitted to District.
  - (1) District's review and comment on the schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements).
  - (2) Contractor shall make corrections to schedule necessary to comply with Contract requirements and shall adjust schedule to incorporate any missing information requested by District. Contractor shall resubmit Initial CPM Schedule if requested by District.

- F. If, during the first ninety (90) days after Notice to Proceed, the Contractor is of the opinion that any of the Work included on its Initial CPM Schedule has been impacted, the Contractor shall submit to District a written Time Impact Evaluation ("TIE") in accordance with Article 1.12 of this Section. The TIE shall be based on the most current update of the Initial CPM Schedule.

### **1.07 ORIGINAL CPM SCHEDULE**

- A. Submit a detailed proposed Original CPM Schedule presenting an orderly and realistic plan for completion of the Work in conformance with requirements as specified herein.
- B. Progress Schedule shall include or comply with following requirements:
- (1) Time scaled, cost and resource (labor and major equipment) loaded CPM schedule.
  - (2) No activity on schedule shall have duration longer than fifteen (15) workdays, with exception of submittal, approval, fabrication and procurement activities, unless otherwise approved by District.
    - (a) Activity durations shall be total number of actual workdays required to perform that activity.
  - (3) The start and completion dates of all items of Work, their major components, and milestone completion dates, if any.
  - (4) District furnished materials and equipment, if any, identified as separate activities.
  - (5) Activities for maintaining Project Record Documents.
  - (6) Dependencies (or relationships) between activities.
  - (7) Processing/approval of submittals and shop drawings for all material and equipment required per the Contract. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.
    - (a) Include time for submittals, re-submittals and reviews by District. Coordinate with accepted schedule for submission of Shop Drawings, samples, and other submittals.
    - (b) Contractor shall be responsible for all impacts resulting from re-submittal of Shop Drawings and submittals.
  - (8) Procurement of major equipment, through receipt and inspection at jobsite, identified as separate activity.
    - (a) Include time for fabrication and delivery of manufactured products for the Work.

- (b) Show dependencies between procurement and construction.
- (9) Activity description; what Work is to be accomplished and where.
- (10) The total cost of performing each activity shall be total of labor, material, and equipment, excluding overhead and profit of Contractor. Overhead and profit of the General Contractor shall be shown as a separate activity in the schedule. Sum of cost for all activities shall equal total Contract value.
- (11) Resources required (labor and major equipment) to perform each activity.
- (12) Responsibility code for each activity corresponding to Contractor or Subcontractor responsible for performing the Work.
- (13) Identify the activities which constitute the controlling operations or critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to (10) days.
- (14) Twenty (20) workdays for developing punch list(s), completion of punch-list items, and final clean up for the Work or any designated portion thereof. No other activities shall be scheduled during this period.
- (15) Interface with the work of other contractors, District, and agencies such as, but not limited to, utility companies.
- (16) Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which CPM was built.
  - (a) Also furnish for each Subcontractor, as determined by District, submitted on Subcontractor letterhead, a statement certifying that Subcontractor concurs with Contractor's Original CPM Schedule and that Subcontractor's related schedules have been incorporated, including activity duration, cost and resource loading.
  - (b) Subcontractor schedules shall be independently derived and not a copy of Contractor's schedule.
  - (c) In addition to Contractor's schedule and resource loading, obtain from electrical, mechanical, and plumbing Subcontractors, and other Subcontractors as required by District, productivity calculations common to their trades, such as units per person day, feet of pipe per day per person, feet of wiring per day per person, and similar information.
  - (d) Furnish schedule for Contractor/Subcontractor CPM schedule meetings which shall be held prior to submission of Original

CPM schedule to District. District shall be permitted to attend scheduled meetings as an observer.

- (17) Activity durations shall be in Work days.
  - (18) Submit with the schedule a list of anticipated non-Work days, such as weekends and holidays. The Progress Schedule shall exclude in its Work day calendar all non-Work days on which Contractor anticipates critical Work will not be performed.
- C. Original CPM Schedule Review Meeting: Contractor shall, within sixty (60) days from the Notice to Proceed date, meet with District to review the Original CPM Schedule submittal.
- (1) Contractor shall have its Project Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by District, in attendance. The meeting will take place over a continuous one (1) day period.
  - (2) District's review will be limited to submittal's conformance to Contract requirements including, but not limited to, coordination requirements. However, review may also include:
    - (a) Clarifications of Contract Requirements.
    - (b) Directions to include activities and information missing from submittal.
    - (c) Requests to Contractor to clarify its schedule.
  - (3) Within five (5) days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by District at the Meeting.

#### **1.08 ADJUSTMENTS TO CPM SCHEDULE**

- A. Adjustments to Original CPM Schedule: Contractor shall have adjusted the Original CPM Schedule submittal to address all review comments from original CPM Schedule review meeting and resubmit network diagrams and reports for District's review.
- (1) District, within ten (10) days from date that Contractor submitted the revised schedule, will either:
    - (a) Accept schedule and cost and resource loaded activities as submitted, or
    - (b) Advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for District to monitor Project's progress, resources, and status or evaluate monthly payment request by Contractor.

- (2) District may accept schedule with conditions that the first monthly CPM Schedule update be revised to correct deficiencies identified.
  - (3) When schedule is accepted, it shall be considered the "Original CPM Schedule" which will then be immediately updated to reflect the current status of the work.
  - (4) District reserves right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work or approval of partial payment requests. No additional compensation will be provided for such adjustments, additions, or clarifications.
- B. Acceptance of Contractor's schedule by District will be based solely upon schedule's compliance with Contract requirements.
- (1) By way of Contractor assigning activity durations and proposing sequence of Work, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the schedule.
  - (2) Upon submittal of schedule update, updated schedule shall be considered "current" CPM Schedule.
  - (3) Submission of Contractor's schedule to District shall not relieve Contractor of total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed Work.
- C. Submittal of Original CPM Schedule, and subsequent schedule updates, shall be understood to be Contractor's representation that the Schedule meets requirements of Contract Documents and that Work shall be executed in sequence indicated on the schedule.
- D. Contractor shall distribute Original CPM Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterheads to Contractor and transmitted to District for the record.

#### **1.09 MONTHLY CPM SCHEDULE UPDATE SUBMITTALS**

- A. Following acceptance of Contractor's Original CPM Schedule, Contractor shall monitor progress of Work and adjust schedule each month to reflect actual progress and any anticipated changes to planned activities.
- (1) Each schedule update submitted shall be complete, including all information requested for the Original CPM Schedule submittal.
  - (2) Each update shall continue to show all Work activities including those already completed. These completed activities shall accurately reflect "as built" information by indicating when activities were actually started and completed.

- B. A meeting will be held on approximately the twenty-fifth (25th) of each month to review the schedule update submittal and progress payment application.
  - (1) At this meeting, at a minimum, the following items will be reviewed: Percent (%) complete of each activity; Time Impact Evaluations for Change Orders and Time Extension Request; actual and anticipated activity sequence changes; actual and anticipated duration changes; and actual and anticipated Contractor delays.
  - (2) These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.
  - (3) Contractor shall plan on the meeting taking no less than four (4) hours.
- C. Within five (5) working days after monthly schedule update meeting, Contractor shall submit the updated CPM Schedule update.
- D. Within five (5) workdays of receipt of above noted revised submittals, District will either accept or reject monthly schedule update submittal.
  - (1) If accepted, percent (%) complete shown in monthly update will be basis for Application for Payment by the Contractor. The schedule update shall be submitted as part of the Contractor's Application for Payment.
  - (2) If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.
- E. Neither updating, changing or revising of any report, curve, schedule, or narrative submitted to District by Contractor under this Contract, nor District's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying in any way the Completion Date or milestone dates or of modifying or limiting in any way Contractor's obligations under this Contract.

#### **1.10 SCHEDULE REVISIONS**

- A. Updating the Schedule to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, revisions to activity durations and sequences are expected on a monthly basis.
- B. To reflect revisions to the Schedule, the Contractor shall provide District with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of work, the Contractor shall provide a schedule diagram which compares the original sequence to the revised sequence of work. The Contractor shall provide the written narrative and schedule diagram for revisions two (2) working days in advance of the monthly schedule update meeting.

- C. Schedule revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District. District may request further information and justification for schedule revisions and Contractor shall, within three (3) days, provide District with a complete written narrative response to District's request.
- D. If the Contractor's revision is still not accepted by District, and the Contractor disagrees with District's position, the Contractor has seven (7) calendar days from receipt of District's letter rejecting the revision to provide a written narrative providing full justification and explanation for the revision. The Contractor's failure to respond in writing within seven (7) calendar days of District's written rejection of a schedule revision shall be contractually interpreted as acceptance of District's position, and the Contractor waives its rights to subsequently dispute or file a claim regarding District's position.
- E. At District's discretion, the Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

#### **1.11 RECOVERY SCHEDULE**

- A. If the Schedule Update shows a completion date twenty-one (21) calendar days beyond the Contract Completion Date, or individual milestone completion dates, the Contractor shall submit to District the proposed revisions to recover the lost time within seven (7) calendar days. As part of this submittal, the Contractor shall provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, the Contractor shall provide a schedule diagram comparing the original sequence to the revised sequence of work.
- B. The revisions shall not be incorporated into any schedule update until the revisions have been reviewed by District.
- C. If the Contractor's revisions are not accepted by District, District and the Contractor shall follow the procedures in paragraph 1.09.C, 1.09.D and 1.09.E above.
- D. At District's discretion, the Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.

#### **1.12 TIME IMPACT EVALUATION ("TIE") FOR CHANGE ORDERS, AND OTHER DELAYS**

- A. When Contractor is directed to proceed with changed Work, the Contractor shall prepare and submit within fourteen (14) calendar days from the Notice to Proceed a TIE which includes both a written narrative and a schedule diagram depicting how the changed Work affects other schedule activities. The schedule diagram shall show how the Contractor proposes to incorporate the changed Work in the schedule and how it impacts the current schedule-update critical path. The Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram must

be tied to the main sequence of schedule activities to enable District to evaluate the impact of changed Work to the scheduled critical path.

- B. Contractor shall be required to comply with the requirements of Paragraph 1.09.A for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.
- C. Contractor shall be responsible for all costs associated with the preparation of TIEs, and the process of incorporating them into the current schedule update. The Contractor shall provide District with four (4) copies of each TIE.
- D. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount District allows, and the Contractor may submit a claim for additional time claimed by contractor.

### **1.13 TIME EXTENSIONS**

- A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accord with the General Conditions.
- B. Where an event for which District is responsible impacts the projected Completion Date, the Contractor shall provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor, equipment, and material the Contractor would expend to mitigate District-caused time impact. The Contractor shall submit its mitigation plan to District within fourteen (14) calendar days from the date of discovery of the impact. The Contractor is responsible for the cost to prepare the mitigation plan.
- C. Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.
- D. No time will be granted under this Contract for cumulative effect of changes.
- E. District will not be obligated to consider any time extension request unless the Contractor complies with the requirements of Contract Documents.
- F. Failure of the Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.
- G. If the Contractor does not submit a TIE within the required fourteen (14) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.



### **1.14 SCHEDULE REPORTS**

- A. Submit four (4) copies of the following reports with the Initial CPM Schedule, the Original CPM Schedule, and each monthly update.
- B. Required Reports:
  - (1) Two activity listing reports: one sorted by activity number and one by total Project Float. These reports shall also include each activity's early/late and actual start and finish dates, original and remaining duration, Project Float, responsibility code, and the logic relationship of activities.
  - (2) Cost report sorted by activity number including each activity's associated cost, percentage of Work accomplished, earned value- to date, previous payments, and amount earned for current update period.
  - (3) Schedule plots presenting time-scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.
  - (4) Cash flow report calculated by early start, late start, and indicating actual progress. Provide an exhibit depicting this information in graphic form.
  - (5) Planned versus actual resource (i.e., labor) histogram calculated by early start and late start.
- C. Other Reports:

In addition to above reports, District may request, from month to month, any two of the following reports. Submit four (4) copies of all reports.

- (1) Activities by early start.
  - (2) Activities by late start.
  - (3) Activities grouped by Subcontractors or selected trades.
  - (4) Activities with scheduled early start dates in a given time frame, such as fifteen (15) or thirty (30) day outlook.
- D. Furnish District with report files on compact disks containing all schedule files for each report generated.

### **1.15 PROJECT STATUS REPORTING**

- A. In addition to submittal requirements for CPM scheduling identified in this Section, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each CPM Schedule as specified herein. Status reporting shall be in form specified below.

- B. Contractor shall prepare monthly written narrative reports of status of Project for submission to District. Written status reports shall include:
- (1) Status of major Project components (percent (%) complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
  - (2) Progress made on critical activities indicated on CPM Schedule.
  - (3) Explanations for any lack of work on critical path activities planned to be performed during last month.
  - (4) Explanations for any schedule changes, including changes to logic or to activity durations.
  - (5) List of critical activities scheduled to be performed next month.
  - (6) Status of major material and equipment procurement.
  - (7) Any delays encountered during reporting period.
  - (8) Contractor shall provide printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.
    - (a) Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor's daily reports. These reports will be basis for information provided in computer-generated monthly and weekly printed reports.
    - (b) Contractor shall explain all variances and mitigation measures.
  - (9) Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by District at no additional cost.
  - (10) Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

#### **1.16 WEEKLY SCHEDULE REPORT**

At the Weekly Progress Meeting, the Contractor shall provide and present a time-scaled three (3) week look-ahead schedule that is based and correlated by activity number to the current schedule (i.e., Initial, Original CPM, or Schedule Update).

#### **1.17 DAILY CONSTRUCTION REPORTS**

On a daily basis, Contractor shall submit a daily activity report to District for each workday, including weekends and holidays when worked. Contractor shall develop the daily construction reports on a computer-generated database capable of sorting daily Work, manpower, and man-hours by Contractor, Subcontractor, area, sub-

area, and Change Order Work. Upon request of District, furnish computer disk of this data base. Obtain District's written approval of daily construction report data base format prior to implementation. Include in report:

- A. Project name and Project number.
- B. Contractor's name and address.
- C. Weather, temperature, and any unusual site conditions.
- D. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to CPM scheduled activities.
- E. Worker quantities for its own Work force and for Subcontractors of any tier.
- F. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

#### **1.18 PERIODIC VERIFIED REPORTS**

Contractor shall complete and verify construction reports on a form prescribed by the Division of the State Architect and file reports on the first day of February, May, August, and November during the preceding quarter year; at the completion of the Contract; at the completion of the Work; at the suspension of Work for a period of more than one (1) month; whenever the services of Contractor or any of Contractor's Subcontractors are terminated for any reason; and at any time a special verified report is required by the Division of the State Architect. Refer to section 4-336 and section 4-343 of Part 1, Title 24 of the California Code of Regulations.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**SUBMITTALS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Contractor's Submittals and Schedules, Drawings and Specifications;
- B. Special Conditions.

**1.02 SECTION INCLUDES:**

- A. Definitions:
  - (1) Shop Drawings and Product Data are as indicated in the General Conditions and include, but are not limited to, fabrication, erection, layout and setting drawings, formwork and falsework drawings, manufacturers' standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams. In addition, there are other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems and all positions conform to the requirement of the Contract Documents, including, without limitation, the Drawings.
  - (2) "Manufactured" applies to standard units usually mass-produced; "fabricated" means specifically assembled or made out of selected materials to meet design requirements. Shop Drawings shall establish the actual detail of manufactured or fabricated items, indicated proper relation to adjoining work and amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure.
  - (3) Manufacturer's Instructions: Where any item of Work is required by the Contract Documents to be furnished, installed, or performed, at a minimum, in accordance with a specified product manufacturer's instructions, the Contractor shall procure and distribute copies of these to the District, the Architect, and all other concerned parties and shall furnish, install, or perform the work, at a minimum, in accordance with those instructions.

- B. Samples, Shop Drawings, Product Data, and other items as specified, in accordance with the following requirements:
- (1) Contractor shall submit all Shop Drawings, Product Data, and Samples to the District, the Architect, the Project Inspector, and the Construction Manager.
  - (2) Contractor shall comply with all time frames herein and in the General Conditions and, in any case, shall submit required information in sufficient time to permit proper consideration and action before ordering any materials or items represented by such Shop Drawings, Product Data, and/or Samples.
  - (3) Contractor shall allow sufficient time so that no delay occurs due to required lead time in ordering or delivery of any item to the Site. Contractor shall be responsible for any delay in progress of Work due to its failure to observe these requirements.
  - (4) Time for completion of Work shall not be extended on account of Contractor's failure to promptly submit Shop Drawings, Product Data, and/or Samples.
  - (5) Reference numbers on Shop Drawings shall have Architectural and/or Engineering Contract Drawings reference numbers for details, sections, and "cuts" shown on Shop Drawings. These reference numbers shall be in addition to any numbering system that Contractor chooses to use or has adopted as standard.
  - (6) When the magnitude or complexity of submittal material prevents a complete review within the stated time frame, Contractor shall make this submittal in increments to avoid extended delays.
  - (7) Contractor shall certify on submittals for review that submittals conform to Contract requirements. Also certify that Contractor-furnished equipment can be installed in allocated space. In event of any variance, Contractor shall specifically state in transmittal and on Shop Drawings, portions vary and require approval of a substitute. Submittals shall not be used as a means of requesting a substitution.
  - (8) Unless specified otherwise, sampling, preparation of samples, and tests shall be in accordance with the latest standard of the American Society for Testing and Materials.
  - (9) Upon demand by Architect or District, Contractor shall submit samples of materials and/or articles for tests or examinations and consideration before Contractor incorporates same in Work. Contractor shall be solely responsible for delays due to sample(s) not being submitted in time to allow for tests. Acceptance or rejection will be expressed in writing. Work shall be equal to approved samples in every respect. Samples that are of value after testing will remain the property of Contractor.

- C. Submittal Schedule:
- (1) Contractor shall prepare its proposed submittal schedule that is coordinated with the proposed construction schedule and submit both to the District within ten (10) days after the date of the Notice to Proceed. Contractor's proposed schedules shall become the Project Construction Schedule and the Project Submittal Schedule after each is approved by the District.
  - (2) Contractor is responsible for all lost time should the initial submittal be rejected, marked "revise and resubmit", etc.
  - (3) All Submittals shall be forwarded to the District by the date indicated on the approved Submittal Schedule, unless an earlier date is necessary to maintain the Construction Schedule, in which case those Submittals shall be forwarded to the District so as not to delay the Construction Schedule.
  - (4) Contractor may be assessed \$100 a day for each day it is late in submitting a shop drawing or sample. No extensions of time will be granted to Trade Contractor or any Subcontractor because of its failure to have shop drawings and samples submitted in accordance with the Schedule.

### **1.03 SHOP DRAWINGS:**

- A. Contractor shall submit one reproducible transparency and six (6) opaque reproductions. The District will review and return the reproducible copy and one (1) opaque reproduction to Contractor.
- B. Before commencing installation of any Work, the Contractor shall submit and receive approval of all drawings, descriptive data, and material list(s) as required to accomplish Work.
- C. Review of Shop Drawings is regarded as a service to assist Contractor and in all cases original Contract Documents shall take precedence as outlined under General Conditions.
- D. No claim for extra time or payment shall be based on work shown on Shop Drawings unless the claim is (1) noted on Contractor's transmittal letter accompanying Shop Drawings and (2) Contractor has complied with all applicable provisions of the General Conditions, including, without limitation, provisions regarding changes and payment, and all required written approvals.
- E. District shall not review Shop Drawings for quantities of materials or number of items supplied.
- F. District's and/or Architect's review of Shop Drawing will be general. District and/or Architect review does not relieve Contractor of responsibility for dimensions, accuracy, proper fitting, construction of Work, furnishing of materials, or Work required by Contract Documents and not indicated on

Shop Drawings. The District's and/or Architect's review of Shop Drawings is not to be construed as approving departures from Contract Documents.

- G. Review of Shop Drawings and Schedules does not relieve Contractor from responsibility for any aspect of those Drawings or Schedules that is a violation of local, County, State, or Federal laws, rules, ordinances, or rules and regulations of commissions, boards, or other authorities or utilities having jurisdiction.
- H. Before submitting Shop Drawings for review, Contractor shall check Shop Drawings of its subcontractors for accuracy, and confirm that all Work contiguous with and having bearing on other work shown on Shop Drawings is accurately drawn and in conformance with Contract Documents.
- I. Submitted drawings and details must bear stamp of approval of Contractor:
  - (1) Stamp and signature shall clearly certify that Contractor has checked Shop Drawings for compliance with Drawings.
  - (2) If Contractor submits a Shop Drawing without an executed stamp of approval, or whenever it is evident (despite stamp) that Drawings have not been checked, the District and/or Architect will not consider them and will return them to the Contractor for revision and resubmission. In that event, it will be deemed that Contractor has not complied with this provision and Contractor shall bear risk of all delays to same extent as if it had not submitted any Shop Drawings or details.
- J. Submission of Shop Drawings (in either original submission or when resubmitted with correction) constitutes evidence that Contractor has checked all information thereon and that it accepts and is willing to perform Work as shown.
- K. Contractor shall pay for cost of any changes in construction due to improper checking and coordination. Contractor shall be responsible for all additional costs, including coordination. Contractor shall be responsible for costs incurred by itself, the District, the Architect, the Project Inspector, the Construction Manager, any other Subcontractor or contractor, etc., due to improperly checked and/or coordination of submittals.
- L. Shop Drawings must clearly delineate the following information:
  - (1) Project name and address.
  - (2) Specification number and description.
  - (3) Architect's name and project number.
  - (4) Shop Drawing title, number, date, and scale.
  - (5) Names of Contractor, Subcontractor(s) and fabricator.

- (6) Working and erection dimensions.
  - (7) Arrangements and sectional views.
  - (8) Necessary details, including complete information for making connections with other Work.
  - (9) Kinds of materials and finishes.
  - (10) Descriptive names of materials and equipment, classified item numbers, and locations at which materials or equipment are to be installed in the Work. Contractor shall use same reference identification(s) as shown on Contract Drawings.
- M. Contractor shall prepare composite drawings and installation layouts when required to solve tight field conditions.
- (1) Shop Drawings shall consist of dimensioned plans and elevations and must give complete information, particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, structural interferences, etc.
  - (2) Contractor shall coordinate these composite Shop Drawings and installation layouts in the field between itself and its Subcontractor(s) for proper relationship to the Work, the work of other trades, and the field conditions. The Contractor shall check and approve all submittal(s) before submitting them for final review.

#### **1.04 PRODUCT DATA OR NON-REPRODUCIBLE SUBMITTALS:**

- A. Contractor shall submit manufacturer's printed literature in original form. Any fading type of reproduction will not be accepted. Contractor must submit a minimum of six (6) each, to the District. District shall return one (1) to the Contractor, who shall reproduce whatever additional copies it requires for distribution.
- B. Contractor shall submit six (6) copies of a complete list of all major items of mechanical, plumbing, and electrical equipment and materials in accordance with the approved Submittal Schedule, except as required earlier to comply with the approved Construction Schedule. Other items specified are to be submitted prior to commencing Work. Contractor shall submit items of like kind at one time in a neat and orderly manner. Partial lists will not be acceptable.
- C. Submittals shall include manufacturer's specifications, physical dimensions, and ratings of all equipment. Contractor shall furnish performance curves for all pumps and fans. Where printed literature describes items in addition to that item being submitted, submitted item shall be clearly marked on sheet and superfluous information shall be crossed out. If highlighting is used, Contractor shall mark all copies.



- D. Equipment submittals shall be complete and include space requirements, weight, electrical and mechanical requirements, performance data, and supplemental information that may be requested.
- E. Imported Materials Certification must be submitted at least ten (10) days before material is delivered.

**1.05 SAMPLES:**

- A. Contractor shall submit for approval Samples as required and within the time frame in the Contract Documents. Materials such as concrete, mortar, etc., which require on-site testing will be obtained from Project Site.
- B. Contractor shall submit four (4) samples except where greater or lesser number is specifically required by Contract Documents including, without limitation, the Specifications.
  - (1) Samples must be of sufficient size and quality to clearly illustrate functional characteristics, with integrally related parts and attachment devices.
  - (2) Samples must show full range of texture, color, and pattern.
- C. Contractor shall make all Submittals, unless it has authorized Subcontractor(s) to submit and Contractor has notified the District in writing to this effect.
- D. Samples to be shipped prepaid or hand-delivered to the District.
- E. Contractor shall mark samples to show name of Project, name of Contractor submitting, Contract number and segment of Work where representative Sample will be used, all applicable Specifications Sections and documents, Contract Drawing Number and detail, and ASTM or FS reference, if applicable.
- F. Contractor shall not deliver any material to Site prior to receipt of District's and/or Architect's completed written review and approval. Contractor shall furnish materials equal in every respect to approved Samples and execute Work in conformance therewith.
- G. District's and/or Architect's review, acceptance, and/or approval of Sample(s) will not preclude rejections of any material upon discovery of defects in same prior to final acceptance of completed Work.
- H. After a material has been approved, no change in brand or make will be permitted.
- I. Contractor shall prepare its Submittal Schedule and submit Samples of materials requiring laboratory tests to specified laboratory for testing not less than ninety (90) days before such materials are required to be used in Work.

- J. Samples which are rejected must be resubmitted promptly after notification of rejection and be marked "Resubmitted Sample" in addition to other information required.
- K. Field Samples and Mock-Ups are to be removed by Contractor at District's direction:
  - (1) Size: As Specified.
  - (2) Furnish catalog numbers and similar data, as requested.

**1.06 REVIEW AND RESUBMISSION REQUIREMENTS:**

- A. The District will arrange for review of Sample(s), Shop Drawing(s), Product Data, and other submittal(s) by appropriate reviewer and return to Contractor as provided below within twenty-one (21) days after receipt or within twenty-one (21) days after receipt of all related information necessary for such review, whichever is later.
- B. One (1) copy of product or materials data will be returned to Contractor with the review status.
- C. Samples to be incorporated into the Work will be returned to Contractor, together with a written notice designating the Sample with the appropriate review status and indicating errors discovered on review, if any. Other Samples will not be returned, but the same notice will be given with respect thereto, and that notice shall be considered a return of the Sample.
- D. Contractor shall revise and resubmit any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) as required by the reviewer. Such resubmittals will be reviewed and returned in the same manner as original Sample(s), Shop Drawing(s), Product Data, and other submittal(s), within fourteen (14) days after receipt thereof or within fourteen (14) days after receipt of all related information necessary for such review. Such resubmittal shall not delay the Work.
- E. Contractor may proceed with any of the Work covered by Sample(s), Shop Drawing(s), Product Data, and other submittal(s) upon its return if designated as no exception taken, or revise as noted, provided the Contractor proceeds in accordance with the District and/or the Architect's notes and comments.
- F. Contractor shall not begin any of the work covered by a Sample(s), Shop Drawing(s), Product Data, and other submittal(s), designated as revise and resubmit or rejected, until a revision or correction thereof has been reviewed and returned to Contractor.
- G. Sample(s), Shop Drawing(s), Product Data, and other submittal(s) designated as revise and resubmit or rejected and requiring resubmittal, shall be revised or corrected and resubmitted to the District no later than fourteen (14) days or a shorter period as required to comply with the approved Construction Schedule, after its return to Contractor.

- H. Neither the review nor the lack of review of any Sample(s), Shop Drawing(s), Product Data, and other submittal(s) shall waive any of the requirements of the Contract Documents, or relieve Contractor of any obligation thereunder.
- I. District's and/or Architect's review of Shop Drawings does not relieve the Contractor of responsibility for any errors that may exist. Contractor is responsible for the dimensions and design of adequate connections and details and for satisfactory construction of all the Work.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**SITE STANDARDS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including without limitation, Site Access, Conditions, and Regulations;
- B. Special Conditions;
- C. Drug-Free Workplace Certification;
- D. Tobacco-Free Environment Certification;
- E. Criminal Background Investigation/Fingerprinting Certification;
- F. Temporary Facilities and Controls.

**1.02 REQUIREMENTS OF THE DISTRICT:**

- A. Drug-Free Schools and Safety Requirements:
  - (1) All school sites and other District Facilities have been declared "Drug-Free Zones." No drugs, alcohol and/or smoking are allowed at any time in any buildings and/or grounds on District property. No students, staff, visitors, or contractors are to use drugs on these sites.
  - (2) Smoking and the use of tobacco products by all persons is prohibited on or in District property. District property includes school buildings, school grounds, school-owned vehicles and vehicles owned by others while on District property. Contractor shall post: "Non-Smoking Area" in a highly visible location in each work area, staging area, and parking area. Contractor may designate a smoking area outside of District property within the public right-of-way, provided that this area remains quiet and unobtrusive to adjacent neighbors. This smoking area is to be kept clean at all times.
  - (3) Contractor shall ensure that no alcohol, firearms, weapons, or controlled substances enter or are used at the Site. Contractor shall immediately remove from the Site and terminate the employment of any employee(s) found in violation of this provision.
- B. Language: Profanity or other unacceptable and/or loud language will not be tolerated, "Cat calls" or other derogatory language toward students, staff, volunteers, parents or public will not be allowed.

- C. Disturbing the Peace (Noise and Lighting):
- (1) Contractor shall observe the noise ordinance of the Site at all times including, without limitation, all applicable local, city, and/or state laws, ordinances, and/or regulations regarding noise and allowable noise levels.
  - (2) The use of radios, etc., shall be controlled to keep all sound at a level that cannot be heard beyond the immediate area of use. District reserves the right to prohibit the use of radios at the Site, except for mobile phones or other handheld communication radios.
  - (3) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.
- D. Traffic:
- (1) Driving on the Premises shall be limited to periods when students and public are not present. If driving or deliveries must be made during the school hours, two (2) or more ground guides shall lead the vehicle across the area of travel. In no case shall driving take place across playgrounds or other pedestrian paths during recess, lunch, and/or class period changes. The speed limit on-the Premises shall be five (5) miles per hour (maximum) or less if conditions require.
  - (2) All paths of travel for deliveries, including without limitation, material, equipment, and supply deliveries, shall be reviewed and approved by District in advance. Any damage will be repaired to the pre-damaged condition by the Contractor.
  - (3) District shall designate a construction entry to the Site. If Contractor requests, District determines it is required, and to the extent possible, District shall designate a staging area so as not to interfere with the normal functioning of school facilities. Location of gates and fencing shall be approved in advance with District and at Contractor's expense.
  - (4) Parking areas shall be reviewed and approved by District in advance. No parking is to occur under the drip line of trees or in softscape areas that could otherwise be damaged.
- E. All of the above shall be observed and complied with by the Contractor and all workers on the Site. Failure to follow these directives could result in individual(s) being suspended or removed from the work force at the discretion of the District. The same rules and regulations shall apply equally to delivery personnel, inspectors, consultants, and other visitors to the Site.

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**REGULATORY REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Obtaining of Permits, Licenses and Registrations and Work to Comply with All Applicable Laws and Regulations;
- B. Special Conditions; and
- C. Quality Control.

**1.02 DESCRIPTION:**

This section covers the general requirements for regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

**1.03 REQUIREMENTS OF REGULATORY AGENCIES:**

- A. All statutes, ordinances, laws, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction over the Work, are hereby incorporated into these Contract Documents as if repeated in full herein and are intended to be included in any reference to Code or Building Code, unless otherwise specified, including, without limitation, the references in the list below. Contractor shall make available at the Site copies of all the listed documents applicable to the Work as the District and/or Architect may request, including, without limitation, applicable portions of the California Code of Regulations ("CCR").
  - (1) California Building Standards Administrative Code, Part 1, Title 24, CCR.
  - (2) California Building Code (CBC), Part 2, Title 24, CCR; (International Building Code volumes 1-2 and California Amendments).
  - (3) California Electrical Code (CEC), Part 3, Title 24, CCR; (National Electrical Code and California Amendments).
  - (4) California Mechanical Code (CMC), Part 4, Title 24, CCR; (Uniform Mechanical Code and California Amendments).
  - (5) California Plumbing Code (CPC), Part 5, Title 24, CCR; (Uniform Plumbing Code and California Amendments).

- (6) California Fire Code (CFC), Part 9, Title 24, CCR; (International Fire Code and California Amendments).
- (7) California Green Building Standards Code (CALGreen), Part 11, Title 24, CCR.
- (8) California Referenced Standards Code, Part 12, Title 24, CCR.
- (9) State Fire Marshal Regulations, Public Safety, Title 19, CCR.
- (10) Partial List of Applicable National Fire Protection Association (NFPA) Standards:
  - (a) NFPA 13 - Automatic Sprinkler System.
  - (b) NFPA 14 - Standpipes Systems.
  - (c) NFPA 17A - Wet Chemical System
  - (d) NFPA 24 - Private Fire Mains.
  - (e) (California Amended) NFPA 72 - National Fire Alarm Codes.
  - (f) NFPA 253 - Critical Radiant Flux of Floor Covering System.
  - (g) NFPA 2001 - Clean Agent Fire Extinguishing Systems.
- (11) California Division of the State Architect interpretation of Regulations ("DSA IR"), including, without limitation:
  - (a) DSA IR A-6 — Construction Change Document Submittal and Approval Processes.
  - (b) DSA IR A-7 — Project Inspector Certification and Approval.
  - (c) DSA IR A-8 — Project Inspector and Assistant Inspector Duties and Performance.
  - (d) DSA IR A-12 — Assistant Inspector Approval.
- (12) DSA Procedures ("DSA PR")
  - (a) DSA PR 13-01 – Construction Oversight Process
  - (b) DSA PR 13-02 – Project Certification Process

B. This Project shall be governed by applicable regulations, including, without limitation, the State of California's Administrative Regulations for the Division of the State Architect-Structural Safety (DSA/SS), Chapter 4, Part 1, Title 24, CCR, and the most current version on the date the bids are opened and as it pertains to school construction including, without limitation:

- (1) Test and testing laboratory per Section 4-335. District shall pay for the testing laboratory.
- (2) Special inspections per Section 4-333(c).
- (3) Deferred Approvals per section 4-317(g).
- (4) Verified reports per Sections 4-336 & 4-343(c).
- (5) Duties of the Architect & Engineers shall be per Sections 4-333(a) and 4-341.
- (6) Duties of the Contractor shall be per Section 4-343.
- (7) Duties of Project Inspector shall be per Section 4-334.
- (8) Addenda and Construction Change Documents per Section 4-338.

Contractor shall keep and make available all applicable parts of the most current version of Title 24 referred to in the plans and specifications at the Site during construction.

- C. Items of deferred approval shall be clearly marked on the first sheet of the Architect's and/or Engineer's approved Drawings. All items later submitted for approval shall be per Title 24 requirements to the DSA.
- (1) Contractor shall submit the following to Architect for review and endorsement:
    - (a) Product information on proposed material/system supplier.
    - (b) Drawings, specifications, and calculations prepared, signed, and stamped by an architect or engineer licensed in the State of California for that portion of the Work.
    - (c) All other requirements as may be required by DSA.
  - (2) Cost of preparing and submitting documentation per DSA Deferred Approval requirements including required modifications to Drawings and Specifications, whether or not indicated in the Contract Documents, shall be borne by Contractor.
  - (3) Contractor shall not begin fabrication and installation of deferred approval items without first obtaining DSA approval of Drawings and Specifications.
  - (4) Schedule of Work Subject to DSA Deferred Approval: Window wall systems exceeding 10 feet in span.



**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**ABBREVIATIONS AND ACRONYMS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

**1.02 DOCUMENT INCLUDES:**

- A. Abbreviations used throughout the Contract Documents.
- B. Reference to a technical society, organization, or body is by abbreviation, as follows:

|     |        |   |
|-----|--------|---|
| 1.  | AA     | The Aluminum Association  |
| 2.  | AASHTO | American Association of State Highway and Transportation Officials        |
| 3.  | ABPA   | Acoustical and Board Products Association                                 |
| 4.  | ACI    | American Concrete Institute   |
| 5.  | AGA    | American Gas Association  |
| 6.  | AGC    | Associated General Contractors of America                                 |
| 7.  | AHC    | Architectural Hardware Consultant   |
| 8.  | AHRI   | Air Conditioning, Heating, Refrigeration Institute                        |
| 9.  | AI     | Asphalt Institute   |
| 10. | AIA    | American Institute of Architects  |
| 11. | AISC   | American Institute of Steel Construction                                  |
| 12. | AISI   | American Iron and Steel Institute   |
| 13. | AMCA   | Air Movement and Control Association                                      |
| 14. | ANSI   | American National Standards Institute                                     |
| 15. | APA    | APA – The Engineered Wood Association                                     |
| 16. | ASCE   | American Society of Civil Engineers                                       |
| 17. | ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| 18. | ASME   | American Society of Mechanical Engineers                                  |
| 19. | ASTM   | American Society of Testing and Materials International                   |
| 20. | AWPA   | American Wood Protection Association                                      |
| 21. | AWPI   | American Wood Preservers Institute  |
| 22. | AWS    | American Welding Society  |
| 23. | AWSC   | American Welding Society Code   |
| 24. | AWI    | Architectural Woodwork Institute  |
| 25. | AWWA   | American Water Works Association  |

|     |                |   |
|-----|----------------|---|
| 26. | BIA            | The Brick Industry Association                                    |
| 27. | CCR            | California Code of Regulations                                    |
| 28. | CLFMI          | Chain Link Fence Manufacturers Institute                          |
| 29. | CRA            | California Redwood Association                                    |
| 30. | CRSI           | Concrete Reinforcing Steel Institute                              |
| 31. | CS             | Commercial Standards  |
| 32. | CSI            | Construction Specifications Institute                             |
| 33. | CTI            | Cooling Technology Institute                                      |
| 34. | FGIA           | Fenestration and Glazing Industry Alliance                        |
| 35. | FGMA           | Flat Glass Manufacturers' Association                             |
| 36. | FIA            | Factory Insurance Association                                     |
| 37. | FM             | Factory Mutual Global   |
| 38. | FS/FED<br>SPEC | Federal Specification   |
| 39. | FTI            | Facing Title Institute  |
| 40. | GA             | Gypsum Association  |
| 41. | IAPMO          | International Association of Plumbing and<br>Mechanical Officials |
| 42. | ICC            | International Code Council  |
| 43. | IEEE           | Institute of Electrical and Electronics Engineers                 |
| 44. | IES            | Illuminating Engineering Society                                  |
| 45. | MCAC           | Mason Contractors Association of California                       |
| 46. | MIMA           | Mineral Wool Insulation Manufacturers<br>Association              |
| 47. | MLMA           | Metal Lath Manufacturers Association                              |
| 48. | MS/MIL<br>SPEC | Military Specifications   |
| 49. | NAAMM          | National Association of Architectural Metal<br>Manufacturers      |
| 50. | NBHA           | National Builders Hardware Association                            |
| 51. | NCMA           | National Concrete Masonry Association                             |
| 52. | NCSEA          | National Council of Structural Engineers<br>Associations          |
| 53. | NEC            | National Electrical Code  |
| 54. | NEMA           | National Electrical Manufacturers Association                     |
| 55. | NIST           | National Institute of Standards and Technology                    |
| 56. | NSI            | Natural Stone Institute   |
| 57. | NTMA           | National Terrazzo and Mosaic Association, Inc.                    |
| 58. | ORS            | Office of Regulatory Services (California)                        |
| 59. | OSHA           | Occupational Safety and Health Act                                |
| 60. | PCI            | Precast/Prestressed Concrete Institute                            |
| 61. | PCA            | Portland Cement Association                                       |
| 62. | PCA            | Painting Contractors Association                                  |
| 63. | PDI            | Plumbing Drainage Institute                                       |
| 64. | PEI            | Porcelain Enamel Institute, Inc.                                  |
| 65. | PG&E           | Pacific Gas & Electric Company                                    |
| 66. | PS             | Product Standards   |
| 67. | SDI            | Steel Door Institute; Steel Deck Institute                        |
| 68. | SJI            | Steel Joist Institute   |
| 69. | SSPC           | Society for Protective Coatings                                   |
| 70. | TCNA           | Tile Council of North America, Inc.                               |
| 71. | TPI            | Truss Plate Institute   |

|     |        |   |
|-----|--------|---|
| 72. | UBC    | Uniform Building Code                                       |
| 73. | UL     | Underwriters Laboratories Code                              |
| 74. | UMC    | Uniform Mechanical Code                                     |
| 75. | USDA   | United States Department of Agriculture                     |
| 76. | VI     | Vermiculite Institute                                       |
| 77. | WCLIB  | West Coast Lumber Inspection Bureau                         |
| 78. | WDMA   | Window and Door Manufacturers Association                   |
| 79. | WEUSER | Western Electric Utilities Service Engineering Requirements |
| 80. | WIC    | Woodwork Institute of California                            |

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**DEFINITIONS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions including without limitation, Definitions;
- B. Special Conditions.

**1.02 QUALITY ASSURANCE**

- A. For products or workmanship specified by association, trade, or Federal Standards, Contractor shall comply with requirements of the standard, except when more rigid requirements are specified in the Contract Documents, or are required by applicable codes.
- B. Contractor shall conform to current reference standard publication date in effect on the date of bid opening.
- C. Contractor shall obtain copies of standards unless specifically required not to by the Contract Documents.
- D. Contractor shall maintain a copy of all standards at jobsite during submittals, planning, and progress of the specific Work, until final completion, unless specifically required not to by the Contract Documents.
- E. Should specified reference standards conflict with Contract Documents, Contractor shall request clarification from the District and/or the Architect before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the contractual relationship as indicated in the Contract Documents by mention or inference otherwise in any referenced document.
- G. Governing Codes shall be as shown in the Contract Documents including, without limitation, the Specifications.

END OF DOCUMENT

**REFERENCES****PART 1 - GENERAL****1.01 SCHEDULE OF REFERENCES:**

**The following information is intended only for the general assistance of the Contractor, and the District does not represent that all of the information is current. It is the Contractor's responsibility to verify the correct information for each of the entities listed.**

|        |   |              |
|--------|---|--------------|
| AA     | The Aluminum Association<br>1400 Crystal Drive, Suite 430<br>Arlington, VA 22202<br><a href="http://www.aluminum.org">www.aluminum.org</a>  | 703/358-2960 |
| AABC   | Associated Air Balance Council<br>2401 Pennsylvania Avenue NW, Suite 330<br>Washington, DC 20037<br><a href="http://www.aabc.com">www.aabc.com</a>  | 202/737-0202 |
| AASHTO | American Association of State Highway and<br>Transportation Officials<br>555 12th St. NW - Suite 1000<br>Washington, DC 20004<br><a href="http://www.transportation.org">www.transportation.org</a> | 202/624-5800 |
| AATCC  | American Association of Textile Chemists and Colorists<br>P.O. Box 12215 Research Triangle Park, NC 27709-2215<br><a href="http://www.aatcc.org">www.aatcc.org</a>                                  | 919/549-8141 |
| ACA    | American Coatings Association<br>901 New York Ave., NW, Suite 300 West<br>Washington, DC 20001<br><a href="http://www.paint.org">www.paint.org</a>  | 202/462-6272 |
| ACI    | American Concrete Institute<br>38800 Country Club Dr.<br>Farmington Hills, MI 48331-3439<br><a href="http://www.concrete.org">www.concrete.org</a>  | 248/848-3800 |
| ACPA   | American Concrete Pipe Association<br>5605 N. MacArthur Blvd., Suite 340<br>Irving, TX 75038<br><a href="http://www.concrete-pipe.org">www.concrete-pipe.org</a>                                    | 972/506-7216 |

|       |   |              |
|-------|---|--------------|
| ADC   | Air Duct Council<br>1901 N. Roselle Road, Suite 800<br>Schaumburg, IL 60195<br><a href="http://www.flexibleduct.org">www.flexibleduct.org</a>                                   | 847/706-6750 |
| AF&PA | American Forest and Paper Association<br>1101 K Street, NW, Suite 700<br>Washington, DC 20005<br><a href="http://www.afandpa.org">www.afandpa.org</a>                           | 202/463-2700 |
| AGA   | American Gas Association<br>400 North Capitol Street, NW, Suite 450<br>Washington, DC 20001<br><a href="http://www.aga.org">www.aga.org</a>                                     | 202/824-7000 |
| AGC   | Associate General Contractors of America<br>2300 Wilson Blvd., Suite 300<br>Arlington, VA 22201<br><a href="http://www.agc.org">www.agc.org</a>                                 | 703/548-3118 |
| AHA   | American Hardboard Association<br>1210 West Northwest Highway<br>Palatine, IL 60067<br><a href="http://domensino.com/AHA/default.htm">http://domensino.com/AHA/default.htm</a>  | 847/934-8800 |
| AI    | Asphalt Institute<br>2696 Research Park Drive<br>Lexington, KY 40511-8480<br><a href="http://www.asphaltinstitute.org">www.asphaltinstitute.org</a>                             | 859/288-4960 |
| AIA   | The American Institute of Architects<br>1735 New York Ave., NW<br>Washington, DC 20006-5292<br><a href="http://www.aia.org">www.aia.org</a>                                     | 202/626-7300 |
| AISC  | American Institute of Steel Construction<br>130 East Randolph Street, Suite 2000<br>Chicago, IL 60601<br><a href="http://www.aisc.org">www.aisc.org</a>                         | 312.670.2400 |
|       |   |              |
| AISI  | American Iron and Steel Institute<br>25 Massachusetts Ave., NW, Suite 800<br>Washington, DC 20001<br><a href="http://www.steel.org">www.steel.org</a>                           | 202/452-7100 |
| AITC  | American Institute of Timber Construction<br>1010 South 336th Street, #210<br>Federal Way, WA 98003-7394<br><a href="https://www.plib.org/aitc/">https://www.plib.org/aitc/</a> | 253/835-3344 |

|                            |  |                              |
|----------------------------|--|------------------------------|
| ALI                        | Associated Laboratories, Inc.<br>P.O. Box 152837<br>Dallas, TX 75315<br>www.assoc-labs.com   | 214/565-0593                 |
| ALSC                       | American Lumber Standards Committee, Inc.<br>7470 New Technology Way, Suite F<br>Frederick, MD 21703<br>www.alsc.org   | 301/972-1700                 |
| AMCA                       | Air Movement and Control Association International, Inc.<br>30 W. University Drive<br>Arlington Heights, IL 60004<br>www.amca.org  | 847/394-0150                 |
| AMPP<br>(formerly<br>SSPC) | Association for Materials Protection and Performance<br>(merger of Society for Protective Coatings and National<br>Association of Corrosion Engineers International)<br>(formerly Steel Structures Painting Council)<br>800 Trumbull Drive<br>Pittsburgh, PA 15205<br>www.sspc.org | 412/281-2331<br>877/281-7772 |
| ANLA                       | AmericanHort (merger of American Nursery & Landscape<br>Association and OFA – The Association of Horticultural<br>Professionals)<br>2130 Stella Court<br>Columbus, OH 43215<br>www.americanhort.org  | 614/487-1117                 |
| ANSI                       | American National Standards Institute<br>1899 L Street, NW, 11th Floor<br>Washington, DC 20036<br>www.ansi.org   | 202/293-8020                 |
| APA                        | APA-The Engineered Wood Association<br>7011 S. 19th Street<br>Tacoma, WA 98466-5333<br>www.apawood.org   | 253/565-6600                 |



|        |   |                              |
|--------|---|------------------------------|
| APA    | Architectural Precast Association<br>325 John Knox Rd, Suite L-103<br>Tallahassee, FL 32303<br><a href="http://www.archprecast.org">www.archprecast.org</a>   | 850/205-5637                 |
| APCIA  | American Property Casualty Insurance Association<br>(merger of American Insurance Association (formerly the<br>National Board of Fire Underwriters) with the Property<br>Casualty Insurers Association of America)<br>555 12th St, NW, Suite 550<br>Washington DC 20004<br><a href="http://www.apci.org">www.apci.org</a> | 202/828-7100                 |
| AHRI   | Air Conditioning and Refrigeration Institute (now Air-<br>Conditioning, Heating, & Refrigeration Institute)<br>2311 Wilson Blvd, Suite 400<br>Arlington, VA 22201<br><a href="http://www.ahrinet.org">www.ahrinet.org</a>   | 703/524-8800                 |
| ARMA   | Asphalt Roofing Manufacturers Association<br>2331 Rock Spring Road<br>Forest Hill, MD 21050<br><a href="http://www.asphaltroofing.org">www.asphaltroofing.org</a>   | 443/640-1075                 |
| ASA    | The Acoustical Society of America<br>Suite 300<br>1305 Walt Whitman Road<br>Melville, NY 11747-4300<br><a href="https://acousticalsociety.org/">https://acousticalsociety.org/</a>  | 516/576-2360                 |
| ASCE   | American Society of Civil Engineers<br>1801 Alexander Bell Drive<br>Reston, VA 20191<br><a href="http://www.asce.org">www.asce.org</a>  | 800/548-2723<br>703/295-6300 |
| ASHRAE | American Society of Heating, Refrigerating and Air<br>Conditioning Engineers<br>180 Technology Parkway<br>Peachtree Corners, GA 30092<br><a href="http://www.ashrae.org">www.ashrae.org</a>   | 800/527-4723<br>404/636-8400 |
| ASLA   | American Society of Landscape Architects<br>636 Eye Street, NW<br>Washington, DC 20001-3736<br><a href="http://www.asla.org">www.asla.org</a>   | 202/898-2444                 |
| ASME   | American Society of Mechanical Engineers<br>Two Park Avenue<br>New York, NY 10016-5990<br><a href="http://www.asme.org">www.asme.org</a>  | 800/834-2763                 |

|      |   |                              |
|------|---|------------------------------|
| ASPE | American Society of Plumbing Engineers<br>6400 Shafer Court, Suite 350<br>Rosemont, IL 60018<br><a href="http://aspe.org">http://aspe.org</a>   | 847/296-0002                 |
| ASQ  | American Society for Quality<br>P.O. Box 3005<br>Milwaukee, WI 53201-3005<br>or<br>600 North Plankinton Avenue<br>Milwaukee, WI 53203<br><a href="http://asq.org">http://asq.org</a>    | 800/248-1946<br>414/272-8575 |
| ASSE | American Society of Sanitary Engineering<br>18927 Hickory Creek Dr., Suite 220<br>Mokena, IL 60448<br><a href="http://www.asse-plumbing.org">www.asse-plumbing.org</a>                  | 708/995-3019                 |
| ASTM | ASTM International<br>100 Barr Harbor Drive<br>PO Box C700<br>West Conshohocken, PA, 19428-2959<br><a href="http://www.astm.org">www.astm.org</a>                                       | 610/832-9500                 |
| AWCI | Association of the Wall and Ceiling Industry<br>513 West Broad Street, Suite 210<br>Falls Church, VA 22046<br><a href="http://www.awci.org">www.awci.org</a>                            | 703/538-1600                 |
| AWPA | American Wood Protection Association<br>(formerly American Wood Preservers Institute)<br>P.O. Box 361784<br>Birmingham, AL 35236-1784<br><a href="http://www.awpa.com">www.awpa.com</a> | 205/733-4077                 |
|      |   |                              |
| AWS  | American Welding Society<br>8669 NW 36 Street, Suite 130<br>Miami, FL 33166<br><a href="http://www.aws.org">www.aws.org</a>   | 800/443-9353<br>305/443-9353 |
| AWI  | Architectural Woodwork Institute<br>46179 Westlake Drive, Suite 120<br>Potomac Falls, VA 20165-5874<br><a href="http://www.awinet.org">www.awinet.org</a>                               | 571/323-3636                 |
| AWWA | American Water Works Association<br>6666 West Quincy Avenue<br>Denver, CO 80235<br><a href="http://www.awwa.org">www.awwa.org</a>   | 800/926-7337<br>303/794-7711 |

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|-------|---|--------------|
| BHMA  | Builders Hardware Manufacturers Association<br>355 Lexington Avenue, 15th Floor<br>New York, NY 10017<br><a href="http://www.buildershardware.com">www.buildershardware.com</a> | 212/297-2122 |
| BIA   | The Brick Industry Association<br>12007 Sunrise Valley Drive, Suite 430<br>Reston, VA 20191<br><a href="http://www.gobrick.com">www.gobrick.com</a>                             | 703/620-0010 |
| CGA   | Compressed Gas Association<br>8484 Westpark Drive, Suite 220<br>McLean, VA 22102<br><a href="http://www.cganet.com">www.cganet.com</a>  | 703/788-2700 |
| CISCA | Ceilings & Interior Systems Construction Association<br>1010 Jorie Blvd, Suite 30<br>Oak Brook, IL 60523<br><a href="http://www.cisca.org">www.cisca.org</a>                    | 630/584-1919 |
| CISPI | Cast Iron Soil Pipe Institute<br>2401 Fieldcrest Dr.<br>Mundelein, IL 60060<br><a href="http://www.cispi.org">www.cispi.org</a>   | 224/864-2910 |
| CLFMI | Chain Link Fence Manufacturers Institute<br>10015 Old Columbia Road, Suite B-215<br>Columbia, MD 21046<br><a href="http://chainlinkinfo.org">chainlinkinfo.org</a>              | 301/596-2583 |
| CPA   | Composite Panel Association<br>19465 Deerfield Avenue, Suite 306<br>Leesburg, VA 20176<br><a href="http://www.compositepanel.org">www.compositepanel.org</a>                    | 703/724-1128 |
| CPSC  | Consumer Product Safety Commission<br>4330 East-West Highway<br>Bethesda, MD 20814<br><a href="http://www.cpsc.gov">www.cpsc.gov</a>  | 800/638-2772 |
| CRA   | California Redwood Association<br>818 Grayson Road, Suite 201<br>Pleasant Hill, CA 94523<br><a href="http://www.calredwood.org">www.calredwood.org</a>                          | 925/935-1499 |

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|-------|---|--------------|
| CRI   | Carpet and Rug Institute<br>100 S. Hamilton Street<br>Dalton, GA 30722-2048<br>www.carpet-rug.org   | 706/278-3176 |
| CRSI  | Concrete Reinforcing Steel Institute<br>933 N. Plum Grove Road<br>Schaumburg, IL 60173-4758<br>www.crsi.org   | 847/517-1200 |
| CSI   | The Construction Specifications Institute<br>123 North Pitt St, Suite 450<br>Alexandria, VA 22314<br>www.csinet.org   | 800/689-2900 |
| CTIOA | Ceramic Tile Institute of America<br>12061 Jefferson Blvd.<br>Culver City, CA 90230-6219<br>www.ctioa.org   | 310/574-7800 |
| DHA   | Decorative Hardwoods Association (formerly Hardwood<br>Plywood & Veneer Association)<br>42777 Trade West Dr.<br>Sterling, VA 20166<br><a href="https://www.decorativehardwoods.org/">https://www.decorativehardwoods.org/</a> | 703/435-2900 |
| DHI   | Door and Hardware Institute<br>(formerly National Builders Hardware Association)<br>2001 K Street NW, 3rd Floor North<br>Washington, DC 20006<br>www.dhi.org  | 202/367-1134 |
| DIPRA | Ductile Iron Pipe Research Association<br>P.O. Box 190306<br>Birmingham, AL 35219<br>www.dipra.org  | 205/402-8700 |
| DOC   | U.S. Department of Commerce<br>1401 Constitution Ave., NW<br>Washington, DC 20230<br>www.commerce.gov   | 202/482-2000 |
| DOT   | U.S. Department of Transportation<br>1200 New Jersey Avenue, SE<br>Washington, DC 20590<br>www.dot.gov  | 855/368-4200 |
| EJMA  | Expansion Joint Manufacturers Association, Inc.<br>25 North Broadway<br>Tarrytown, NY 10591<br>www.ejma.org   | 914/332-0040 |

|              |  |                              |
|--------------|--|------------------------------|
| EPA          | Environmental Protection Agency<br>Ariel Rios Building<br>1200 Pennsylvania Avenue, N.W.<br>Washington, DC 20460<br><a href="http://www.epa.gov">www.epa.gov</a>   | 202/272-0167                 |
| FCICA        | Floor Covering Installation Contractors Association<br>800 Roosevelt Rd., Bldg. C, Suite 312<br>Glen Ellyn, IL 60137<br><a href="http://www.fcica.com">www.fcica.com</a>   | 630/672-3702                 |
| FGIA         | Fenestration and Glazing Industry Alliance<br>1900 E Golf Rd, Suite 1250<br>Schaumburg, IL 60173<br><a href="https://fgiaonline.org/">https://fgiaonline.org/</a>  | 847/303-5664                 |
| FM<br>Global | Factory Mutual Insurance Company<br>Amy Daley<br>Global Practice Leader – Education, Public Entities,<br>Health Care<br>FM Global<br>270 Central Avenue<br>Johnston, RI 02919-4949<br><a href="http://www.fmglobal.com">www.fmglobal.com</a> | 401/275-3000<br>401/275-3029 |
| FS           | General Services Administration (GSA) Index of Federal<br>Specifications, Standards and Commercial Item<br>Descriptions<br>470 East L'Enfant Plaza, SW, Suite 8100<br>Washington, DC 20407<br><a href="http://www.gsa.gov">www.gsa.gov</a>   | 202/619-8925                 |
| GA           | The Gypsum Association<br>962 Wayne Ave., Suite 620<br>Silver Spring, MD 20910<br><a href="http://www.gypsum.org">www.gypsum.org</a>   | 301/277-8686                 |
|              |  |                              |
| HMA          | Hardwood Manufacturers Association<br>One Williamsburg Place, Suite 108<br>Warrendale, PA 15086<br><a href="http://hmamembers.org">http://hmamembers.org</a>   | 412/244-0440                 |

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| IAPMO                       | International Association of Plumbing and Mechanical Officials<br>(formerly the Western Plumbing Officials Association)<br>4755 E. Philadelphia St.<br>Ontario, CA 91761<br><a href="http://www.iapmo.org">www.iapmo.org</a> | 909/472-4100                 |
| ICC                         | International Code Council<br>500 New Jersey Avenue, NW, 6th Floor<br>Washington, DC 20001<br><a href="http://www.iccsafe.org">www.iccsafe.org</a>   | 888/422-7233                 |
| IEEE                        | Institute of Electrical and Electronics Engineers<br>3 Park Avenue, 17th Floor<br>New York, NY 10016-5997<br><a href="http://www.ieee.org">www.ieee.org</a>  | 212/419-7900                 |
| IES                         | Illuminating Engineering Society<br>120 Wall Street, Floor 17<br>New York, NY 10005-4001<br><a href="http://www.ies.org">www.ies.org</a>   | 212/248-5000                 |
| ITRK                        | Intertek Testing Services<br>3933 US Route 11<br>Cortland, NY 13045<br><a href="http://www.intertek.com">www.intertek.com</a>  | 607/753-6711                 |
| MCAA                        | Mechanical Contractors Association of America<br>1385 Piccard Drive<br>Rockville, MD 20850<br><a href="http://www.mcaa.org">www.mcaa.org</a>   | 301/869-5800                 |
| MMPA<br>(formerly<br>WMMPA) | Moulding & Millwork Producers Association<br>(formerly Wood Moulding & Millwork Producers<br>Association)<br>507 First Street<br>Woodland, CA 95695<br><a href="http://www.wmmpa.com">www.wmmpa.com</a>                      | 530/661-9591<br>800/550-7889 |
| MSS                         | Manufacturers Standardization Society (MSS) of the<br>Valve and Fittings Industry, Inc.<br>127 Park Street, NE<br>Vienna, VA 22180-4602<br><a href="http://mss-hq.org">http://mss-hq.org</a>                                 | 703/281-6613                 |
| NAAMM                       | National Association of Architectural Metal Manufacturers<br>800 Roosevelt Rd. Bldg. C, Suite 312<br>Glen Ellyn, IL 60137<br><a href="http://www.naamm.org">www.naamm.org</a>  | 630/942-6591                 |

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| NAIMA | North American Insulation Manufacturers Association<br>P.O. Box 1906 Alexandria, VA 22313<br><a href="https://insulationinstitute.org/">https://insulationinstitute.org/</a>  | 703/684-0084                 |
| NALP  | National Association of Landscape Professionals<br>(formerly Professional Landcare Network)<br>12500 Fair Lakes Circle, Suite 200<br>Fairfax, VA 22033<br><a href="https://www.landscapeprofessionals.org/">https://www.landscapeprofessionals.org/</a> | 703/736-9666                 |
| NAPA  | National Asphalt Pavement Association<br>6406 Ivy Lane, Suite 350<br>Greenbelt, MD 20770-1441<br><a href="http://www.asphaltpavement.org">www.asphaltpavement.org</a>   | 888/468-6499<br>301/731-4748 |
| NCSPA | National Corrugated Steel Pipe Association<br>14070 Proton Road, Suite 100<br>Dallas, TX 75244<br><a href="http://www.ncspa.org">www.ncspa.org</a>  | 972/850-1907                 |
| NCMA  | National Concrete Masonry Association<br>13750 Sunrise Valley Drive<br>Herndon, VA 20171-4662<br><a href="http://www.ncma.org">www.ncma.org</a>   | 703/713-1900                 |
| NEBB  | National Environmental Balancing Bureau<br>8575 Grovemont Circle<br>Gaithersburg, MD 20877<br><a href="http://www.nebb.org">www.nebb.org</a>  | 301/977-3698                 |
| NECA  | National Electrical Contractors Association<br>1201 Pennsylvania Ave. NW<br>Washington, D.C., 20004<br><a href="http://www.necanet.org">www.necanet.org</a>   | 202/991-6300                 |
| NEMA  | National Electrical Manufacturers Association<br>1300 North 17th Street N, Suite 900<br>Rosslyn, VA 22209<br><a href="http://www.nema.org">www.nema.org</a>   | 703/841-3200                 |
| NEII  | National Elevator Industry, Inc.<br>5537 SW Urish Road<br>Topeka, KS 66610<br><a href="https://nationalelevatorindustry.org/">https://nationalelevatorindustry.org/</a>   | 703/589-9985                 |
| NFPA  | National Fire Protection Association<br>1 Batterymarch Park<br>Quincy, MA 02169-7471<br><a href="http://www.nfpa.org">www.nfpa.org</a>  | 800/344-3555<br>855/274-8525 |

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| NGA<br>(formerly<br>GANA) | National Glass Association (merged with Glass Association of North America)<br>1945 Old Gallows Road Suite 750<br>Vienna, VA 22182<br>www.glass.org   | 866/342-5642 Ext 127         |
| NHLA                      | National Hardwood Lumber Association<br>PO Box 34518<br>Memphis, TN 38184<br>www.nhla.com   | 901/377-1818                 |
| NIA                       | National Insulation Association<br>516 Herndon Pkwy., Ste. D<br>Herndon, VA 20170<br>www.insulation.org   | 703/464-6422                 |
| NRCA                      | National Roofing Contractors Association<br>10255 W. Higgins Road, Suite 600<br>Rosemont, IL 60018-5607<br>www.nrca.net   | 847/299-9070                 |
| NSF                       | NSF International<br>789 N. Dixboro Road<br>Ann Arbor, MI 48113-0140<br>www.nsf.org   | 800/673-6275<br>734/769-8010 |
| NSI                       | Natural Stone Institute (formerly Marble Institute of America)<br>380 E. Lorain St.<br>Oberlin, OH 44074<br><a href="https://www.naturalstoneinstitute.org/">https://www.naturalstoneinstitute.org/</a> | 440/250-9222                 |
| NTMA                      | National Terrazzo and Mosaic Association<br>209 N. Crockett Street, Suite 2<br>PO Box 2605<br>Fredericksburg, TX 78624<br>www.ntma.com  | 800/323-9736                 |
| OSHA                      | Occupational Safety and Health Act<br>U.S. Department of Labor<br>Occupational Safety & Health Administration<br>200 Constitution Ave., NW<br>Washington, DC 20210<br>www.osha.gov                      | 800/321-OSHA<br>(6742)       |



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| PCA  | Portland Cement Association<br>5420 Old Orchard Road<br>Skokie, IL 60077<br>or<br>200 Massachusetts Ave NW, Suite 200<br>Washington, DC 20001<br>www.cement.org   | 847/966-6200<br>202/408-9494 |
| PCA  | Painting Contractors Association (formerly Painting and<br>Decorating Contractors of America)<br>2316 Millpark Drive<br>Maryland Heights, MO 63043<br><a href="https://www.pcapainted.org/">https://www.pcapainted.org/</a> | 800/322-7322                 |
| PCI  | Precast/Prestressed Concrete Institute<br>8770 W. Bryn Mawr Ave., Suite 1150<br>Chicago, IL 60631<br>www.pci.org  | 312/786-0300                 |
| PDI  | Plumbing & Drainage Institute<br>800 Turnpike Street, Suite 300<br>North Andover, MA 01845<br><a href="http://pdionline.org">http://pdionline.org</a>   | 978/557-0720<br>800/589-8956 |
| PEI  | Porcelain Enamel Institute, Inc.<br>P.O. Box 920220<br>Norcross, GA 30010<br>www.porcelainenamel.com  | 770/676-9366                 |
| PG&E | Pacific Gas & Electric Company<br>P.O. Box 997300<br>Sacramento, CA 95899-7300<br>www.pge.com   | 800/743-5000                 |
| PLIB | Pacific Lumber Inspection Bureau (formerly West Coast<br>Lumber Inspection Bureau)<br>1010 South 336th Street, Suite 210<br>Federal Way, WA 98003-7394<br><a href="https://www.plib.org/">https://www.plib.org/</a>         | 253/835-3344                 |
| RFCI | Resilient Floor Covering Institute<br>115 Broad Street, Suite 201<br>La Grange, GA 30240<br>www.rfci.com  | 706/882-3833                 |
| SDI  | Steel Deck Institute<br>P.O. Box 426<br>Glenshaw, PA 15116<br>www.sdi.org   | 412/487-3325                 |

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| SDI    | Steel Door Institute<br>30200 Detroit Road<br>Westlake, OH 44145<br>www.steeldoor.org  | 440/899-0010                 |
| SJI    | Steel Joist Institute<br>140 West Evans Street, Suite 203<br>Florence, SC 29501<br>http://steeljoist.org   | 843/407-4091                 |
| SMA    | Stucco Manufacturers Association<br>5753 E Santa Ana Cyn Rd, #G-156<br>Anaheim, CA 92807<br>www.stuccomfgassoc.com   | 714/473-9579                 |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association<br>4201 Lafayette Center Drive<br>Chantilly, VA 20151-1219<br>www.smacna.org              | 703/803-2980                 |
| SPI    | SPI: The Plastics Industry Trade Association, Inc.<br>1425 K St. NW, Suite 500<br>Washington, DC 20005<br>www.plasticsindustry.org                           | 202/974-5200                 |
|        |  |                              |
| TCA    | The Tile Council of North America<br>100 Clemson Research Blvd.<br>Anderson, SC 29625<br>www.tcnatile.com  | 864/646-8453                 |
| TPI    | Truss Plate Institute<br>2670 Crain Highway, Suite 203<br>Waldorf, MD 20601<br>www.tpinst.org  | 240/587-5582                 |
| TPI    | Turfgrass Producers International<br>444 E. Roosevelt Road #346<br>Lombard, IL 60148<br>www.turfgrassod.org  | 800/405-8873<br>847/649-5555 |
| TCIA   | Tree Care Industry Association<br>(formerly the National Arborist Association)<br>670 N Commercial Street, Suite 201<br>Manchester, NH 03101<br>www.tcia.org | 603/314-5380<br>800/733-2622 |

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| TVI  | The Vermiculite Institute<br>c/o The Schundler Company<br>10 Central Street<br>Nahant, MA 01908<br><a href="http://www.vermiculiteinstitute.org">www.vermiculiteinstitute.org</a> | 732/287-2244                 |
| UL   | Underwriters Laboratories Inc.<br>333 Pfingsten Road<br>Northbrook, IL 60062-2096<br><a href="http://www.ul.com">www.ul.com</a>   | 847/272-8800<br>877/854-3577 |
| UNI  | Uni-Bell PVC Pipe Association<br>201 E. John Carpenter Freeway, Suite 750<br>Irving, TX 75062<br><a href="http://www.uni-bell.org">www.uni-bell.org</a>                           | 972/243-3902                 |
| USDA | U.S. Department of Agriculture<br>1400 Independence Ave., S.W.<br>Washington, DC 20250<br><a href="http://www.usda.gov">www.usda.gov</a>  | 202/720-2791                 |
| WA   | Wallcoverings Association<br>35 E Wacker Dr., Suite 850<br>Chicago, IL 60601<br><a href="http://www.wallcoverings.org">www.wallcoverings.org</a>                                  | 312/224-2574                 |
| WCMA | Window Covering Manufacturers Association<br>355 Lexington Avenue 15th Floor<br>New York, NY 10017<br><a href="http://www.wcmanet.org">www.wcmanet.org</a>                        | 212/297-2122                 |
| WDMA | Window & Door Manufacturers Association<br>2001 K Street NW, 3rd Floor North<br>Washington, D.C. 20006<br><a href="http://www.wdma.com">www.wdma.com</a>                          | 202/367-1157                 |
| WI   | Woodwork Institute<br>1455 Response Road, Suite 110<br>Sacramento, CA 95815<br><a href="http://www.wicnet.org">www.wicnet.org</a>   | 916/372-9943                 |
| WRI  | Wire Reinforcement Institute<br>942 Main Street, Suite 300<br>Hartford, CT 06103<br><a href="http://www.wirereinforcementinstitute.org">www.wirereinforcementinstitute.org</a>    | 860/240-9545                 |
| WWCA | Western Wall & Ceiling Contractors Association<br>1910 N. Lime St.<br>Orange, CA 92865<br><a href="http://www.wwcca.org">www.wwcca.org</a>  | 714/221-5520                 |

|      |  |              |
|------|--|--------------|
| WWPA | Western Wood Products Association (formerly Redwood Inspection Service)<br>1500 SW First Ave., Suite 870<br>Portland, OR 97201<br><a href="http://www.wwpa.org">www.wwpa.org</a> | 503/224-3930 |
|------|--|--------------|

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**MATERIALS AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Purchase of Materials and Equipment;
- B. Special Conditions;
- C. Imported Materials Certification.

**1.02 MATERIAL AND EQUIPMENT**

- A. Only items approved by the District and/or Design Professional shall be used.
- B. Contractor shall submit lists of products and other product information in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.

**1.03 MATERIAL AND EQUIPMENT COLORS**

- A. The District and/or Architect will provide a schedule of colors.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples in accordance with the Contract Documents, including, without limitation, the provisions regarding the submittals.
- C. Contractor shall request priority in writing for any item requiring advance ordering to maintain the approved Construction Schedule.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Contractor shall deliver manufactured materials in original packages, containers, or bundles (with seals unbroken), bearing name or identification mark of manufacturer.
- B. Contractor shall deliver fabrications in as large assemblies as practicable; where specified as shop-primed or shop-finished, package or crate as required to preserve such priming or finish intact and free from abrasion.
- C. Contractor shall store materials in such a manner as necessary to properly protect them from damage. Materials or equipment damaged by handling, weather, dirt, or from any other cause will not be accepted.

- D. Materials are not acceptable that have been warehoused for long periods of time, stored or transported in improper environment, improperly packaged, inadequately labeled, poorly protected, excessively shipped, deviated from normal distribution pattern, or reassembled.
- E. Contractor shall store material so as to cause no obstructions of sidewalks, roadways, access to the Site or buildings, and underground services. Contractor shall protect material and equipment furnished under Contract.
- F. Contractor may store materials on Site with prior written approval by the District, all material shall remain under Contractor's control and Contractor shall remain liable for any damage to the materials. Should the Project Site not have storage area available, the Contractor shall provide for off-site storage at a bonded warehouse and with appropriate insurance coverage at no cost to District.
- G. When any room in Project is used as a shop or storeroom, the Contractor shall be responsible for any repairs, patching, or cleaning necessary due to that use. Location of storage space shall be subject to prior written approval by District.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers listed in various sections of Contract Documents are names of those manufacturers that are believed to be capable of supplying one or more of items specified therein.
- B. The listing of a manufacturer does not imply that every product of that manufacturer is acceptable as meeting the requirements of the Contract Documents.

### **2.02 FACILITIES AND EQUIPMENT**

Contractor shall provide, install, maintain, and operate a complete and adequate facility for handling, the execution, disposal, and distribution of material and equipment as required for proper and timely performance of Work connected with Contract.

### **2.03 MATERIAL REFERENCE STANDARDS**

Where material is specified solely by reference to "standard specifications" and if requested by District, Contractor shall submit for review data on actual material proposed to be incorporated into Work of Contract listing name and address of vendor, manufacturer, or producer, and trade or brand names of those materials, and data substantiating compliance with standard specifications.

## **PART 3 - EXECUTION**

### **3.01 WORKMANSHIP**

- A. Where not more specifically described in any other Contract Documents, workmanship shall conform to methods and operations of best standards and accepted practices of trade or trades involved and shall include items of fabrication, construction, or installation regularly furnished or required for completion (including finish and for successful operation, as intended).
- B. Work shall be executed by tradespersons skilled in their respective lines of Work. When completed, parts shall have been durably and substantially built and present a neat appearance.

### **3.02 COORDINATION**

- A. Contractor shall coordinate installation of Work so as to not interfere with installation of others. Adjustment or rework because of Contractor's failure to coordinate will be at no additional cost to District.
- B. Contractor shall examine in-place work for readiness, completeness, fitness to be concealed or to receive other work, and in compliance with Contract Documents. Concealing or covering Work constitutes acceptance of additional cost which will result should in-place Work be found unsuitable for receiving other Work or otherwise deviating from the requirements of the Contract Documents.

### **3.03 COMPLETENESS**

Contractor shall provide all portions of the Work, unless clearly stated otherwise, installed complete and operational with all elements, accessories, anchorages, utility connections, etc., in manner to assure well-balanced performance, in accordance with manufacturer's recommendations and by Contract Documents. For example, electric water coolers require water, electricity, and drain services; roof drains require drain system; sinks fit within countertop, etc. Terms such as "installed complete," "operable condition," "for use intended," "connected to all utilities," "terminate with proper cap," "adequately anchored," "patch and refinish," "to match similar," should be assumed to apply in all cases, except where completeness of functional or operable condition is specifically stated as not required.

### **3.04 APPROVED INSTALLER OR APPLICATOR**

Installation by a manufacturer's approved installer or applicator is an understood part of Specifications and only approved installer or applicator is to provide on-site Work where specified manufacturer has on-going program of approving (i.e. certifying, bonding, re-warranting) installers or applicators. Newly established relationships between a manufacturer and an installer or applicator who does not have other approved applicator work in progress or completed is not approved for this Project.

### **3.05 MANUFACTURER'S RECOMMENDATIONS**

All installations shall be in accordance with manufacturer's published recommendations and specific written directions of manufacturer's representative. Should Contract Documents differ from recommendations of manufacturer or directions of his representative, Contractor shall analyze differences, make recommendations to the District and the Architect in writing, and shall not proceed until interpretation or clarification has been issued by the District and/or the Architect.

END OF DOCUMENT



**QUALITY CONTROL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections and Tests, Uncovering of Work and Non-conforming of Work and Correction of Work;
- B. Special Conditions.

**1.02 RELATED CODES:**

- A. The Work is governed by requirements of Title 24, California Code of Regulations ("CCR"), and the Contractor shall keep a copy of these available at the job Site for ready reference during construction.
- B. The Division of the State Architect ("DSA") shall be notified at or before the start of construction.

**1.03 OBSERVATION AND SUPERVISION:**

- A. The District and Architect or their appointed representatives will review the Work and the Contractor shall provide facilities and access to the Work at all times as required to facilitate this review. Administration by the Architect and any consulting Structural Engineer will be in accordance with applicable regulations, including, without limitation, CCR, Part 1, Title 24, Section 4-341.
- B. One or more Project Inspector(s) approved by DSA and employed by or in contract with the District, referred to hereinafter as the "Project Inspector", will observe the work in accordance with CCR, Part 1, Title 24, Sections 4-333(b) and 4-342:
  - (1) The Project Inspector and Special Inspector(s) shall have access to the Work wherever it is in preparation or progress for ascertaining that the Work is in accordance with the Contract Documents and all applicable code sections. The Contractor shall provide facilities and operation of equipment as needed, and access as required and shall provide assistance for sampling or measuring materials.
  - (2) The Project Inspector will notify the District and Architect and call the attention of the Contractor to any observed failure of Work or material to conform to Contract Documents.

- (3) The Project Inspector shall observe and monitor all testing and inspection activities required.

The Contractor shall conform with all applicable laws as indicated in the Contract Documents, including, without limitation, to CCR, Part 1, Title 24, Section 4-343. The Contractor shall supervise and direct the Work and maintain a competent superintendent on the job who is authorized to act in all matters pertaining to the Work. The Contractor's superintendent shall also inspect all materials, as they arrive, for compliance with the Contract Documents. Contractor shall reject defective Work or materials immediately upon delivery or failure of the Work or material to comply with the Contract Documents. The Contractor shall submit verified reports as indicated in the Contract Documents, including, without limitation, the Specifications and as required by Part 1, Title 24, Section 4-336.

#### **1.04 TESTING AGENCIES:**

- A. Testing agencies and tests shall be in conformance with the General Documents and the requirements of Part 1, Title 24, Section 4- 335.
- B. Testing and inspection in connection with earthwork shall be under the direction of the District's consulting soils engineer, if any, referred to hereinafter as the "Soils Engineer."
- C. Testing and inspection of construction materials and workmanship shall be performed by a qualified laboratory, referred to hereinafter as the "Testing Laboratory." The Testing Laboratory shall be under direction of an engineer registered in the State of California, shall conform to requirements of ASTM E329, and shall be employed by or in contract with the District.

#### **1.05 TESTS AND INSPECTIONS:**

- A. The Contractor shall be responsible for notifying the District and Project Inspector of all required tests and inspections. Contractor shall notify the District and Project Inspector at least seventy-two hours (72) hours in advance of performing any Work requiring testing or inspection.
- B. The Contractor shall provide access to Work to be tested and furnish incidental labor, equipment, and facilities to facilitate all inspections and tests.
- C. The District will pay for first inspections and tests required by the "CCR", and other inspections or tests that the District and/or the Architect may direct to have made, including the following principal items:
  - (1) Tests and observations for earthwork and paving.
  - (2) Tests for concrete mix designs, including tests of trial batches.
  - (3) Tests and inspections for structural steel work.
  - (4) Field tests for framing lumber moisture content.

- (5) Additional tests directed by the District that establish that materials and installation comply with the Contract Documents.
- (6) Tests and observations of welding and expansion anchors.
- D. The District may at its discretion, pay and then back charge the Contractor for:
  - (1) Retests or reinspection's, if required, and tests or inspections required due to Contractor error or lack of required identifications of material.
  - (2) Uncovering of work in accordance with Contract Documents.
  - (3) Testing done on weekends, holidays, and overtime will be chargeable to the Contractor for the overtime portion.
  - (4) Testing done off Site.
- E. Testing and inspection reports and certifications:
  - (1) If initially received by Contractor, Contractor shall provide to each of the following a copy of the agency or laboratory report of each test or inspection or certification.
    - (a) The District;
    - (b) The Construction Manager, if any;
    - (c) The Architect;
    - (d) The Consulting Engineer, if any;
    - (e) Other engineers on the Project, as appropriate;
    - (f) The Project Inspector; and
    - (g) The Contractor.
  - (2) When the test or inspection is one required by the CCR, a copy of the report shall also be provided to the DSA.

## **PART 2 - PRODUCTS**

### **2.01 TYPE OF TESTS AND INSPECTIONS**

- A. Testing and inspection shall be in accordance with DSA Form 103 (or current version) See Exhibit D
- B. Slump Test  
ASTM C 143
- C. Concrete Tests

Testing agency shall test concrete used in the work per the following paragraphs:

- (1) Compressive Strength:
  - (a) Minimum number of tests required: One (1) set of three (3) cylinders for each 100 cubic yards (Sec. 2604(h) 01) of concrete or major fraction thereof, placed in one (1) day. See Title 24, Section 2605(g).
  - (b) Two cylinders of each set shall be tested at twenty-eight (28) days. One (1) cylinder shall be held in reserve and tested only when directed by the Architect or District.
  - (c) Concrete shall test the minimum ultimate compressive strength in twenty-eight 28 days, as specified on the structural drawings.
  - (d) In the event that the twenty-eight (28) day test falls below the minimum specified strength, the effective concrete in place shall be tested by taking cores in accordance with UBC Standard No. 26-13 and tested as required for cylinders.
  - (e) In the event that the test on core specimens falls below the minimum specified strength, the concrete will be deemed defective and shall be removed and replaced upon such direction of the Architect, and in a manner acceptable to the Division of the State Architect.

D. Reinforcing, Steel

E. Structural Steel Per Title 24 and as noted:

- (1) Material: Steel per Table in Title 24, Section 2712.
- (2) Qualification of Welders (UBC Std. 27-6).
- (3) Shop fabrication (Section 2712(d). Structural steel only).
- (4) Shop and field welding (Section 2712(e)).

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions;
- C. Site Standards; and
- D. Construction Waste Management and Disposal.

**1.02 TEMPORARY UTILITIES:**

- A. Electric Power and Lighting:
  - (1) Contractor will pay for power during the course of the Work. To the extent power is available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver that power service from its existing location in the building(s) or on the Site to point of intended use.
  - (2) Contractor shall verify characteristics of power available in building(s) or on the Site. Contractor shall take all actions required to make modifications where power of higher voltage or different phases of current are required. Contractor shall be fully responsible for providing that service and shall pay all costs required therefor.
  - (3) Contractor shall furnish, wire for, install, and maintain temporary electrical lights wherever it is necessary to provide illumination for the proper performance and/or observation of the Work: a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work.
  - (4) Contractor shall be responsible for maintaining existing lighting levels in the project vicinity should temporary outages or service interruptions occur.
- B. Heat and Ventilation:
  - (1) Contractor shall provide temporary heat to maintain environmental conditions to facilitate progress of the Work, to meet specified

minimum conditions for the installation and curing of materials, and to protect materials and finishes from damage due to improper temperature and humidity conditions. Portable heaters shall be standard units complete with controls.

- (2) Contractor shall provide forced ventilation and dehumidification, as required, of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and gases.
- (3) Contractor shall pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.

C. Water:

- (1) Contractor shall pay for water used during the course of the Work. Contractor shall coordinate and pay for installation or use of water meter in compliance with local water agency requirements. To the extent water is then available in the building(s) or on the Site, Contractor may use the District's existing utilities by making prearranged payments to the District for the utilities used by Contractor and all Subcontractors. Contractor shall be responsible for providing temporary facilities required to deliver such utility service from its existing location in the building(s), on the Site, or other location approved by the local water agency, to point of intended use.
- (2) Contractor shall use backflow preventers on water lines at point of connection to District's water supply. Backflow preventers shall comply with requirements of Uniform Plumbing Code.
- (3) Contractor shall make potable water available for human consumption.

D. Sanitary Facilities:

- (1) Contractor shall provide sanitary temporary facilities in no fewer numbers than required by law and such additional facilities as may be directed by the Inspector for the use of all workers. The facilities shall be maintained in a sanitary condition at all times and shall be left at the Site until removal is directed by the Inspector or Contractor completes all other work at the Site.
- (2) Use of toilet facilities in the Work under construction shall not be permitted except by consent of the Inspector and the District.

E. Telephone Service:

- (1) Contractor shall arrange with local telephone service company for telephone service as required for the performance of the Work. Contractor shall, at a minimum, provide in its field office one line for telephone and one line for fax machine.

- (2) Contractor shall pay the costs for telephone and fax lines installation, maintenance, service, and removal.

F. Fire Protection:

- (1) Contractor shall provide and maintain fire extinguishers and other equipment for fire protection. Such equipment shall be designated for use for fire protection only and shall comply with all requirements of the California Fire, State Fire Marshall and/or its designee.
- (2) Where on-site welding and burning of steel is unavoidable, Contractor shall provide protection for adjacent surfaces.

G. Trash Removal:

- (1) Contractor shall provide trash removal on a daily basis. Under no circumstance shall Contractor use District trash service.

~~H. Field Office:~~

- ~~(1) If Contractor chooses to provide a field office, it shall be an acceptable construction trailer that is well lit and ventilated. The construction trailer shall be equipped with shelves, desks, filing cabinet, chairs, and such other items of equipment needed. Trailer and equipment are the property of the Contractor and must be removed from the Site upon completion of the Work. Contractor shall coordinate lay down area with the District Representative for approval in writing.~~
- ~~(2) Contractor shall provide any additional electric lighting and power required for the trailer. Contractor shall make adequate provisions for heating and cooling as required.~~

I. Temporary Facilities: n/a

- (1)

**1.03 CONSTRUCTION AIDS:**

A. Plant and Equipment:

- (1) Contractor shall furnish, operate, and maintain a complete plant for fabricating, handling, conveying, installing, and erecting materials and equipment; and for conveyances for transporting workers. Include elevators, hoists, debris chutes, and other equipment, tools, and appliances necessary for performance of the Work.
- (2) Contractor shall maintain plant and equipment in safe and efficient operating condition. Damages due to defective plant and equipment, and uses made thereof, shall be repaired by Contractor at no expense to the District.

- B. None of the District's tools and equipment shall be used by Contractor for the performance of the Work.

**1.04 BARRIERS AND ENCLOSURES:**

- A. Contractor shall obtain the District's written permission for locations and types of temporary barriers and enclosures, including fire-rated materials proposed for use, prior to their installation.
- B. Contractor shall provide and maintain temporary enclosures to prevent public entry and to protect persons using other buildings and portions of the Site and/or Premises, the public, and workers. Contractor shall also protect the Work and existing facilities from the elements, and adjacent construction and improvements, persons, and trees and plants from damage and injury from demolition and construction operations.
- C. Contractor shall provide site access to existing facilities for persons using other buildings and portions of the Site, the public, and for deliveries and other services and activities.
- D. Tree and Plant Protection:
  - (1) Contractor shall preserve and protect existing trees and plants on the Premises that are not designated or required to be removed, and those adjacent to the Premises.
  - (2) Contractor shall provide barriers to a minimum height of 4'-0" around drip line of each tree and plant, around each group of trees and plants, as applicable, in the proximity of demolition and construction operations, or as denoted on the Plans.
  - (3) Contractor shall not park trucks, store materials, perform Work or cross over landscaped areas. Contractor shall not dispose of paint thinners, water from cleaning, plastering or concrete operations, or other deleterious materials in landscaped areas, storm drain systems, or sewers. Plant materials damaged as a result of the performance of the Work shall, at the option of the District and at Contractor's expense, either be replaced with new plant materials equal in size to those damaged or by payment of an amount representing the value of the damaged materials as determined by the District.
  - (4) Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at Contractor's expense.
  - (5) Excavation around Trees:
    - (a) Excavation within drip lines of trees shall be done only where absolutely necessary and with written permission from the District.



- (b) Where trenching for utilities is required within drip lines, tunneling under and around roots shall be by hand digging and shall be approved by the District. Main lateral roots and taproots shall not be cut. All roots 2 inches in diameter and larger shall be tunneled under and heavily wrapped with wet burlap so as to prevent scarring or excessive drying. Smaller roots that interfere with installation of new work may be cut with prior approval by the District. Roots must first be cut with a Vermeer, or equivalent, root cutter prior to any trenching.
- (c) Where excavation for new construction is required within drip line of trees, hand excavation shall be employed to minimize damage to root system. Roots shall be relocated in backfill areas wherever possible. If encountered immediately adjacent to location of new construction, roots shall be cut approximately 6 inches back from new construction.
- (d) Approved excavations shall be carefully backfilled with the excavated materials approved for backfilling. Backfill shall conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities. Do not use mechanical equipment to compact backfill. Tamp carefully using hand tools, refilling and tamping until Final Acceptance as necessary to offset settlement.
- (e) Exposed roots shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover shall be provided, or roots shall be wrapped with four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently relocated and covered with backfill.
- (f) Accidentally broken roots should be sawed cleanly 3 inches behind ragged end.

**1.05 SECURITY:**

The Contractor shall be responsible for project security for materials, tools, equipment, supplies, and completed and partially completed Work.

**1.06 TEMPORARY CONTROLS:**

A. Noise Control:

- (1) Contractor acknowledges that adjacent facilities may remain in operation during all or a portion of the Work period, and it shall take all reasonable precautions to minimize noise as required by applicable laws and the Contract Documents.
- (2) Notice of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to the District a minimum of forty-eight (48) hours in advance of their performance.

B. Noise and Vibration:

- (1) Equipment and impact tools shall have intake and exhaust mufflers.
- (2) Contractor shall cooperate with District to minimize and/or cease the use of noisy and vibratory equipment if that equipment becomes objectionable by its longevity.

C. Dust and Dirt:

- (1) Contractor shall conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities.
- (2) Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
- (3) Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins, and as otherwise required by local and state ordinance.
- (4) Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.

D. Water:

- (1) Contractor shall not permit surface and subsurface water, and other liquids, to accumulate in or about the vicinity of the Premises. Should accumulation develop, Contractor shall control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

E. Pollution:

- (1) No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Premises.
- (2) Contractor shall comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of the Work including, without limitation, demolition, construction, and disposal operations.

F. Lighting:

- (1) If portable lights are used after dark, all light must be located so as not to direct light into neighboring property.

## **1.07 JOB SIGN(S):**

### **A. General:**

- (1) Contractor shall provide and maintain a Project identification sign with the design, text, and colors designated by the District and/or the Design Professional; locate sign as approved by the District.
- (2) Signs other than the specified Project sign and or signs required by law, for safety, or for egress, shall not be permitted, unless otherwise approved in advance by the District.

### **B. Materials:**

- (1) Structure and Framing: Structurally sound, new or used wood or metal; wood shall be nominal 3/4-inch exterior grade plywood.
- (2) Sign Surface: Minimum 3/4-inch exterior grade plywood.
- (3) Rough Hardware: Galvanized.
- (4) Paint: Exterior quality, of type and colors selected by the District and/or the Design Professional.

### **C. Fabrication:**

- (1) Contractor shall fabricate to provide smooth, even surface for painting.
- (2) Size: 4'-0" x 8'-0", unless otherwise indicated.
- (3) Contractor shall paint exposed surfaces of supports, framing, and surface material with exterior grade paint: one coat of primer and one coat of finish paint.
- (4) Text and Graphics: As indicated.

## **1.08 PUBLICITY RELEASES:**

- A. Contractor shall not release any information, story, photograph, plan, or drawing relating information about the Project to anyone, including press and other public communications medium, including, without limitation, on website(s) without the written permission of the District.

## **PART 2 – PRODUCTS Not used.**

## **PART 3 – EXECUTION Not used.**

END OF DOCUMENT

**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

**1.02 SECTION INCLUDES:**

- A. Administrative and procedural requirements for the following:
  - (1) Salvaging non-hazardous construction waste.
  - (2) Recycling non-hazardous construction waste.
  - (3) Disposing of non-hazardous construction waste.

**1.03 DEFINITIONS:**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### **1.04 PERFORMANCE REQUIREMENTS:**

- A. General: Develop waste management plan that results in end-of Project rates for salvage/recycling of sixty-five percent (65%) by weight (or by volume, but not a combination) of total waste generated by the Work.

#### **1.05 SUBMITTALS:**

- A. Waste Management Plan: Submit waste management plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include the following information:
  - (1) Material category.
  - (2) Generation point of waste.
  - (3) Total quantity of waste in tons or cubic yards.
  - (4) Quantity of waste salvaged, both estimated and actual in tons or cubic yards.
  - (5) Quantity of waste recycled, both estimated and actual in tons or cubic yards.
  - (6) Total quantity of waste recovered (salvaged plus recycled) in tons or cubic yards.
  - (7) Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for final payment, submit copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- H. Qualification Data: For Waste Management Coordinator.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- J. Submittal procedures and quantities are specified in Document 01 33 00.

#### **1.06 QUALITY ASSURANCE:**

- A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to waste management including, but not limited to, the following:
  - (1) Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
  - (2) Review requirements for documenting quantities of each type of waste and its disposition.
  - (3) Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - (4) Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - (5) Review waste management requirements for each trade.

#### **1.07 WASTE MANAGEMENT PLAN:**

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measurement throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

- (1) Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
- (2) Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
- (3) Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
- (4) Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
- (5) Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- (6) Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

**PART 2 - PRODUCTS Not Used.**

**PART 3 - EXECUTION**

**3.01 PLAN IMPLEMENTATION:**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - (1) Comply with Document 01 50 00 for operation, termination, and removal requirements.
- B. [Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.]
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - (1) Distribute waste management plan to everyone concerned within 3 days of submittal return.

- (2) Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - (1) Designate and label specific areas of Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - (2) Comply with Document 01 50 00 for controlling dust and dirt, environmental protection, and noise control.

### **3.02 RECYCLING CONSTRUCTION WASTE:**

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to the Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
  - (1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project Site. Include list of acceptable and unacceptable materials at each container and bin.
    - (a) Inspect containers and bins for contamination and remove contaminated materials if found.
  - (2) Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - (3) Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - (4) Store components off the ground and protect from the weather.
  - (5) Remove recyclable waste off District property and transport to recycling receiver or processor.
- D. Packaging:
  - (1) Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - (2) Polystyrene Packaging: Separate and bag material.



- (3) Pallets: As much as possible, require deliveries using pallets to remove pallets from Project Site. For pallets that remain on Site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- (4) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- E. Site-Clearing Wastes: Chip brush, branches, and trees on site.
- F. Wood Materials:
  - (1) Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - (2) Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- G. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
  - (1) Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### **3.03 DISPOSAL OF WASTE:**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - (1) Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on site.
  - (2) Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off District property and legally dispose of them.

END OF DOCUMENT

**FIELD OFFICES**

**~~PART 1—GENERAL~~**

**~~1.01—RELATED DOCUMENTS AND PROVISIONS:~~**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Temporary Facilities and Controls.

**~~1.02—SECTION INCLUDES:~~**

- A. Requirements for Field Offices and Field Office Trailers.

**~~1.03—SUMMARY:~~**

- A. General: Contractor shall provide District's Field Office Trailer and contents, for District's use exclusively, during the term of the Contract.
- B. Property: Trailer, furniture, furnishings, equipment, and the like, supplied by the Contractor with the Office Trailer shall remain the property of the Contractor; District property items installed, delivered, and the like by District within the Office Trailer will remain District's property.
- C. Modifications: District reserves the right to modify the trailer or contents, or both, as may be deemed proper by District.
- D. Condition: Trailer and contents shall be clean, neat, substantially finished, in good, proper, and safe condition for use, operation, and the like; the trailer and contents shall not be required to be new.
- E. Installation Timing: Provide safe, fully furnished, functional, proper, complete, and finished trailer properly ready for entire use, within fourteen (14) calendar days of District's notification of the issuance of Notice to Proceed.

**~~1.04—SUBMITTALS:~~**

- A. General: Submit submittals to District in quantity, format, type, and the like, as specified herein.
- B. Office Trailer Data: One (1) copy of manufacturer's descriptive data, technical descriptions, regulatory compliance, industry standards, installation, removal, and maintenance instructions.

- C. ~~Equipment Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.~~
- D. ~~Furniture and Furnishings Data: Two (2) copies of manufacturer data for each type of equipment, if directed by District.~~
- E. ~~Plans: One (1) reproducible copy of appropriately scaled plans of trailer layout. Plans shall include, but not be limited to: lighting; furniture; equipment; telephone and electrical outlets; and the like.~~
- F. ~~Product Samples: One (1) complete and entire unit of each type, if directed by District.~~

### **~~1.05 QUALITY ASSURANCE~~**

- A. ~~Standards: In the event that provisions of codes, regulations, safety orders, Contract Documents, referenced manufacturer's specifications, manufacturer's instructions, industry standards, and the like, are in conflict, the more restrictive and higher quality shall govern.~~
- B. ~~Installer: Installer or Installers engaged by Contractor must have a minimum of five (5) years of documented and properly authenticated successful experience of specialization in the installation of the items or systems, or both, specified herein.~~
- C. ~~Manufacturer: Contractor shall obtain products from nationally and industry recognized Manufacturer with five (5) years minimum, of immediately recent, continuous, documented and properly authenticated successful experience of specialization in the manufacture of the product specified herein.~~
- D. ~~State Personnel Training: Provide proper training for maintenance and operations, including emergency procedures, and the like, as directed by District.~~
- E. ~~Units: Shall be sound and free of defects, and shall not include any damage or defect that will impair the safety, installation, performance, or the durability of the entire Office Trailer and appurtenant systems.~~

### **~~1.06 REGULATORY REQUIREMENTS~~**

- A. ~~General: Work shall be executed in accordance with applicable Codes, Regulations, Statutes, Enactments, Rulings, Laws, each authority having jurisdiction, and including, but not limited to, Regulatory Requirements specified herein.~~
- B. ~~California Building Standards Code ("CBSC").~~
- C. ~~California Code of Regulations, Title 25, Chapter 3, Sub Chapter 2, Article 3 ("CCR").~~

- ~~D. Coach Insignia: Trailer shall display California Commercial Coach Insignia; such insignia shall be deemed to show that the trailer is in accordance with the Construction and Fire Safety requirements of CCR.~~

## **~~PART 2—PRODUCTS~~**

### **~~2.01—FIELD OFFICE TRAILER~~**

- ~~A. General: Provide entire Field Office Trailer of type, function, operation, capacity, size, complete with controls, safety devices, accessories, and the like, for proper and durable installation. Partitions, walls, ceiling, and other interior and exterior surfaces shall be appropriately finished, including, but not limited to, trim, painting, wall base, floor covering, suspended or similar ceiling, and the like; provide systems, components, units, nuts, bolts, screws, anchoring devices, fastening devices, washers, accessories, adhesives, sealants, and other items of type, grade, and class required for the particular use, not identified but required for a complete, weather tight, appropriately operating, and finished installation.~~
- ~~B. Manufacturers: General Electric Capital Modular Space; The Space Place, Inc.; or equal.~~
- ~~C. Program: Provide a wheel mounted trailer with stairs, landings, platforms, ramps, and the like, in good, proper, safe, clean, and properly finished condition; with proper heavy duty locks, and other proper and effective security at all doors, windows, and the like. Trailer shall be maintained in good, proper, safe, clean, and properly finished condition during the Contract.~~
- ~~(1) Nominal Trailer Size: Four hundred eighty (480) square feet, minimum.~~
- ~~(2) Stairs, Platform: Properly finished stairs, platforms, and ramps.~~
- ~~(3) Doors: Two (2), three (3) foot wide exterior doors with locksets; finished ramp, steps, and entry platform at each exterior door.~~
- ~~(4) Keys: Submit five (5) keys for each door, window, furniture unit, and the like. There shall be no other key copies or originals available; each key shall be identified for District; and shall be labeled, or tagged or both, as directed by District.~~
- ~~(5) HVAC:~~
- ~~(6) Lighting: Sixty five (65) foot candles illumination minimum at any point, at thirty (30) inches above finished floor throughout from fluorescent light source, exclusively, or as directed by District.~~
- ~~(7) Electrical Outlets: One (1) duplex outlet evenly spaced every twelve (12) linear horizontal feet of wall face, and electrical service ready for use.~~

- ~~(8) — Telephones and Telephone Outlets: Two (2) telephone lines wired, connected to telephone utility service, and ready for use, and two (2) telephone instruments, each with two (2) line capability, speed dial and hands free feature. Locate each outlet as directed by District.~~

## **~~2.02 — FIELD OFFICE TRAILER ITEMS~~**

- ~~A. — General: Provide the Field Office Trailer with the following arranged into two (2) workstations:~~

~~(1) — Desks: Two (2) desks: thirty six (36) inches by sixty (60) inches; steel, laminated plastic top; locking, one (1) or two (2) file drawers single pedestal; steel; provide five (5) keys to District.~~

~~(2) — Tables: Two (2) tables; thirty six (36) inches by sixty (60) inches; twenty nine (29) inches high; steel, laminated plastic top tables; one (1) at each desk.~~

~~(3) — Chairs: Two (2) chairs: swivel; steel; with seat cushion and arms; one (1) at each desk.~~

~~(4) — Waste Baskets: Two (2) waste baskets, one at each desk.~~

- ~~B. — Furniture and Equipment: Provide in the space located to effect efficient and logical use:~~

~~(1) — File cabinet: One (1); four (4) drawer; lateral; steel locking.~~

~~(2) — Plan Table: One (1) plan table: thirty six (36) inches deep by seventy two (72) inches wide by forty two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawers.~~

~~(3) — Drafting Stool: One (1) drafting stool; swiveling; steel; padded; adjustable; with footrest and casters.~~

~~(4) — Bookshelf: One (1) bookshelf: thirty six (36) inches deep by seventy two (72) inches wide by forty two (42) inches high; adjustable; wood or steel; with lockable plan and pencil drawer.~~

~~(5) — Plan Rack: One (1) wheel mounted plan rack.~~

~~(6) — Waste Baskets: One (1) large waste basket.~~

~~(7) — Coat/Hat Hanger: Wall mounted with minimum capacity for four (4) garments and ten (10) hats.~~

~~(8) — Document Management System: Shall include an integrated high-volume printer, copier, and facsimile machine, including stand, base, and storage cabinet; and shall include the following features:~~

~~(a) — Type: Laser, dry electrostatic transfer, plain paper, digital, multi-function imaging system.~~

- ~~(b) Network: Ethernet or Token Ring network ready, Plug and Play.~~
- ~~(c) Print, send/receive facsimile from any connected workstation.~~
- ~~(d) Resolution: Six hundred (600) dots per inch by six hundred (600) dots per inch, minimum.~~
- ~~(e) Print Speed: Twenty (20) pages per minute, minimum.~~
- ~~(f) Copies: Twenty (20) copies per minute, minimum.~~
- ~~(g) Document Handler: Forty (40) sheet, minimum~~
- ~~(h) Collator: Forty (40) bin, minimum, with stapling.~~
- ~~(i) Duplexing: Capable.~~
- ~~(j) Paper Size: Capable of handling paper sizes to eleven (11) inches by seventeen (17) inches.~~
- ~~(k) Paper Cassettes: One (1) each for eight and one half (8.5) inches by eleven (11) inches, eight and one half (8.5) inches by fourteen (14) inches, and eleven (11) inches by seventeen (17) inches paper sizes; minimum two hundred fifty (250) sheets per cassette.~~
- ~~(l) Reduction/Enlargement: Capable of reduction to twenty five percent (25%) and enlargement to two hundred percent (200%).~~
- ~~(m) Facsimile Electronic Storage: Capable of storing minimum of fifty (50) speed dial numbers, group faxing and broadcast faxing.~~
- ~~(n) Facsimile Scanning: Capable of scanning into memory a minimum of one hundred (100) pages with maximum scan time of three (3) seconds per page.~~
- ~~(o) Halftone: Sixty four (64) levels.~~
- ~~(p) Redial: Automatic and Manual.~~
- ~~(9) Maintenance: Contractor shall purchase service agreements for each unit of equipment for the duration of the project plus two (2) months, and shall maintain all equipment in proper working condition. Service agreements shall include provision for replacement of toner cartridges and other items required to effect proper unit use. Service agreements shall also provide for:~~
  - ~~(a) Unlimited Service Calls.~~

- ~~(b) Same Day Response.~~
- ~~(c) All parts, labor, preventative maintenance and mileage.~~
- ~~(d) All chemicals, such as toner, fixing agent, and the like.~~
- ~~(e) System training and setup.~~
- ~~(10) Portable Toilets: Two (2); each shall include a urinal; each unit shall be a properly enclosed chemical unit conforming to ANSI Z4.3.~~
  - ~~(a) Location: As directed by District.~~
  - ~~(b) Maintenance: Maintain each unit and surrounding areas in a clean, hygienic and orderly manner, at all time. Empty, clean, and sanitize each unit each day at a location and time as directed by District.~~
  - ~~(c) Removal: Relocate, or remove from the site, each Portable Toilet. Upon such directive by District, the Contractor shall forthwith relocate or remove each Portable Toilet and submit the affected areas to a condition which existed prior to the installation of each Portable Toilet, within three (3) calendar days, or as directed by District in writing, at no cost to District.~~

## ~~2.03 UTILITY AND SERVICES~~

- ~~A. Telephone Service: Contractor shall provide and interface the entire telephone service and shall properly and timely pay for telephone service for District's non long distance use.~~
- ~~B. Electrical Service: Provide all proper connections and continuously pay for service for the duration of the Work.~~

## ~~2.04 FINISHES~~

- ~~A. General: Manufacturer standard finish system over surfaces properly cleaned, pretreated, and prepared to obtain proper bond; all visible surfaces shall be coated.~~
- ~~B. Finish: Color as selected by District from manufacturer standard palette.~~

## ~~PART 3 EXECUTION~~

### ~~3.01 INSTALLATION~~

- ~~A. General: Properly prepare area and affected items to receive the Work. Set Work accurately in location, alignment, and elevation; rigidly, securely, and firmly anchor to appropriate structure; install plumb, straight, square, level, true, without racking, rigidly anchored to proper solid blocking, substrate, and the like; provide appropriate type and quantity of reinforcements, fasteners, adhesives, self adhesive and other tapes; lubricants, coatings, accessories,~~

and the like, as required for a complete, structurally rigid, stable, sound, and appropriately finished installation, in accordance with manufacturer's published instructions, and as indicated. The more restrictive and higher quality requirement shall govern. Moving parts shall be properly secured, without binding, looseness, noise, and the like.

- B. ~~Installation: Install in accordance with 25 CCR 3.2.3 and as directed by District; jack up trailer and level both ways; mount on proper concrete piers with all load off wheels; provide required tie down and accessories per Section 4368 of referenced CCR, and as directed by District.~~
- C. ~~Rejected Work: Work, materials, unit, items, systems, and the like, not accepted by District shall be deemed rejected, and shall forthwith be removed and replaced with proper and new Work, materials, unit, items, systems, and the like at no cost to District.~~
- D. ~~Standard: Comply with manufacturer's published instructions, or with instructions as shown or indicated; the more restrictive and higher quality requirement shall govern.~~
- E. ~~Location: As directed by District.~~
- F. ~~Fire Resistance: Construct and install in accordance with UL requirements.~~
- G. ~~Maintenance: Contractor shall maintain trailer and adjacent areas in a safe, clean and hygienic condition throughout the duration of the Work, and as directed by District. Properly repair or replace furniture or other items, as directed by District. Properly remove unsafe, damaged, or broken furniture, or similar items, and replace with safe and proper items. Contractor shall pay cost of all services, repair, and maintenance, or replacement of each item.~~
- H. ~~Janitorial Service: Provide professional janitorial services, including, but not limited to, trash, waste paper baskets, fill paper dispensers; clean and dust all furniture, files, and the like; sweep and mop resilient and similar flooring; and vacuum carpeting and similar flooring.~~
  - (1) ~~Frequency: Two (2) times per week, minimum.~~
- I. ~~Removal: Properly remove the Office Trailer and contents from the Site upon completion of the Contract, or as directed by District in writing. Forthwith properly patch and repair affected areas; replace damaged items with new items. Carefully and properly inventory, clean, pack, store, and protect District property; submit District property to District at a date, time and location as directed by District.~~

END OF DOCUMENT



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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

SECTION 01 56 39 – TEMPORARY TREE PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Protection for existing trees.
  - 2. Repair and replacement of damaged trees.

1.02 RELATED REQUIREMENTS

- A. Section 32 8000, Irrigation.
- B. Section 32 9000, Landscaping.

1.03 REFERENCES AND STANDARDS

- A. American National Standard Institute (ANSI) A300 Pruning Standards.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Submittal Procedures:
  - 1. Action Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
  - 2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

1.05 ACTION SUBMITTALS

- A. Fenced Tree Protection Area Plan: Submit plan outlining trees listed by number to be protected and their groupings. Trees shall be grouped in their own Fenced Tree Protection Areas as shown in Drawings.
- B. Schedule of Activities Inside Tree Protection Area: Submit in writing a schedule, including any and all activity inside Fenced Tree Protection Areas. This schedule to include but not limited to the dates fences are initially installed, altered and dates of fence replacement. Intent of these provisions is that the Tree Protection Zones (TPZ) are fenced for the entire duration with only exceptions of short intervals or specifically defined construction activity needs. Revise schedule as directed.
- C. Mediation Plan: Submit mediation plan to keep existing trees and planting irrigated during construction.

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Plan: For replaced trees.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing.

2.02 MATERIALS

- A. Trunk Protection constructed of:
  - 1. 20-foot long 2x6 wood boards or length needed to protect the trunk if tree trunk is shorter than 20 feet in height.
  - 2. Metal wire. Gauge strong enough to tie the boards around the trunk of the tree.
- B. Tree Protection Zone Fencing:
  - 1. 6-foot-tall metal chain link construction fencing.
- C. Bark Mulch: Untreated, shredded cedar.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR TREES BE RETAINED

- A. Maintain pre-existing moisture levels.
- B. Maintain areas inside the fenced tree protection area including lawn mowing, leaf removal, operation and repair of irrigation.
- C. Protect root systems from flooding, erosion, excessive watering and drying resulting from dewatering or other operations:
- D. Operations not Allowed:
  - 1. Run off or spillage of damaging materials in vicinity of root systems.
  - 2. Rinsing of tools or equipment under trees.
  - 3. Storage of materials, stockpile soil, park or drive vehicles within drip lines.
  - 4. Cutting, breaking skin or bark, or bruising roots or branches.
  - 5. Fires under and adjacent trees.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

6. Discharge exhaust under foliage.
7. Securing cable, chain, or rope to trees.
8. Change of grade within drip line of trees without Landscape Architect's approval.
9. The use of lime.

3.02 TREE TRUNK PROTECTION

- A. Conform to requirements for trees to be retained, in accordance with article GENERAL REQUIREMENTS FOR TREES TO BE RETAINED.
- B. Install boards vertically around tree and bind together with wire to protect the bark 360 degrees around the entire tree prior to start of any demolition and construction. Boards are not to dig into bark.
- C. Major scaffold limbs may require plastic fencing to be wrapped around them for protection.

3.03 TREE DRIPLINE PROTECTION

- A. The Tree Protection Zone (TPZ) is a restricted area around the base of the tree with a radius of one foot (1') for every inch of tree trunk diameter or ten feet, which ever is greater, enclosed by 6' tall chain link fence unless otherwise directed.
- B. Signage designating the protection zone and penalties for violations shall be secured in prominent location on each protection fence.

3.04 TREE PROTECTION

- A. Duration: Tree protection shall be erected before demolition, grading, or any construction begins and remain in place until final inspection of the project.
- B. Conform to requirements for trees and plants to be retained, in accordance with article GENERAL REQUIREMENTS FOR TREES TO BE RETAINED.
- C. Construction shall not commence until approval of the Fenced Tree Protection Area Plan and Schedule of Activities Inside Tree Protection Area have been obtained from the Architect.
- D. Vehicle movement within the TPZ will only be allowed for construction equipment.
  1. Within dripline, apply 10-inch layer of mulch over geotextile fabric.
- E. Perform trenching operations within the TPZ of the tree so that:
  1. Digging shall be by hand using narrow trenching shovel.
  2. No roots larger than 2" diameter are cut and utilities are routed around or below them.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Roots smaller than 2" diameter are cut with sharp tools, saws, loppers; not torn, chopped or broken.

F. Where roots are exposed:

1. Do not allow the roots to dry out.
2. On the same day the excavation is made, provide temporary backfill to original grade at tree roots,
3. Or cover roots with 4 layers of wet untreated burlap, made wet each day, including weekends.

G. Roots larger than 3" in diameter are not to be cut without review and approval by an Arborist provided by Owner.

3.05 REPAIR AND REPLACEMENT OF TREES

A. Repair or replace damaged trees as required or directed.

B. Repair trees damaged by operations:

1. within 24 hours of damage,
2. to satisfaction of Landscape Architect,
3. to ANSI A300 Pruning Standards.

C. Replace repaired trees where repair has not restored them to health or aesthetics:

1. within 6 months of request to replace,
2. to the satisfaction of Landscape Architect,
3. with replacement trees of a size and variety matching those that were removed,

D. Replaced trees shall be maintained in good health and aesthetics for the duration of the project from installation.

1. Submit comprehensive maintenance plan for replacement trees, including but not limited to provisions for irrigation system independent of existing system.

E. Where suitable replacement of trees is not available:

1. Submit affidavit to Landscape Architect that they are not available.
2. Provide compensation to Owner at the following rates:
  - a. \$2000 for each caliper inch of tree removed under 12 inches.
  - b. \$4000 for each caliper inch of tree removed 12 inches or greater.
  - c. Caliper of trees measured at 6 inches above grade.
  - d. Caliper defined here as thickness of diameter, measured in inches.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.06 SOIL CONTAMINATION

- A. Remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants,
  - 1. Replace with good soil in conformance with Section 31 0000, Earthwork, at Contractor's expense.

END OF SECTION

## SECTION 01 57 13 - EROSION CONTROL

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. General: Provide all materials, equipment and labor necessary to furnish and install straw wattles at locations shown on the Drawings and on Contractors Storm Water Pollution Prevention Plan.
- B. Storm Water Pollution Prevention Plan: Contractor will be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) or waiver, and submit to the State Water Resource Control Board to obtain Notice of Intent approval and a WDID number. Comply with State Water Resources Control Board requirements. The SWPPP shall be provided by the Contractor prior to the start of work. The SWPPP shall be tailored to the contractor's approach to the work in this contract. The SWPPP shall be prepared by a Qualified SWPPP Developer (QSD). The Contractor shall as a minimum address:
  - 1. Cut and fill operations.
  - 2. Temporary stockpiles.
  - 3. Vehicle and equipment storage, maintenance and fueling operations.
  - 4. Concrete, plaster, mortar and paint disposal.
  - 5. Dust control.
  - 6. Tracking of dirt, mud on off-site streets.
  - 7. Erosion Controls
  - 8. Sediment Controls

#### 1.02 QUALITY ASSURANCE

- . General: Comply with governing codes and regulations.

#### 1.03 SUBMITTALS

- A. SWPPP: Contractors Qualified SWPPP Developer (QSD) shall submit to the State Water Resources Control Board via Storm water Multi Application and Report Tracking System (SMARTS) and obtain a Notice of Intent and WDID number prior to beginning work on site.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Straw Wattles: Shall be new manufactured straw roles in compliance with state requirements for sediment control.
- B. Filter Bag: Shall be as required by local jurisdiction.

### PART 3 - EXECUTION

3.01 INSTALLATION

- A. All BMPS shall be installed per the drawings, CASQA standards and as required by the SWPPP.

3.02 MAINTENANCE AND REMOVAL:

- A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until hydroseed is placed.
- B. Monitoring: Based on determined Risk Level of Contractor's SWPPP provide monitoring of erosion and sediment control measures before, during and after storm events. Site monitoring shall be performed by a Qualified SWPPP Practitioner. Update SWPPP continuously throughout construction period and provide reporting and testing as required by the current NPDES permit. Testing and reporting of turbidity and ph will be required for a project determined to be Risk Level 2. Contractor's QSD/QSP will be required to prepare AdHoc reports of all testing on the State Water Resources Control Board's SMARTS database
- C. Cleaning: Keep area clean of debris.
- D. Remove all sediment control measures following site stabilization.
- E. The Contractor's QSD and QSP will be responsible for preparing and gaining approval of the annual report(s) and Notice of Termination on the State Water Resources Control Board's SMARTS database following project completion.

END OF SECTION

**OWNER-FURNISHED PRODUCTS**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions;
- B. Special Conditions; and
- C. Materials and Equipment.

**1.02 SECTION INCLUDES**

- A. Requirements for the following:
  - (1) Installing Owner-furnished materials and equipment.
  - (2) Providing necessary utilities, connections and rough-ins.

**1.03 DEFINITIONS**

- A. Owner: District, who is providing/furnishing materials and equipment.
- B. Installing Contactor: Contractor, who is installing the materials and equipment furnished by the Owner.

**1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Receive, store and handle products in accordance with the manufacturer's instructions.
- B. Protect equipment items as required to prevent damage during storage and construction.

**PART 2 – PRODUCTS**

**2.01 GENERAL PRODUCT REQUIREMENTS**

- A. Installing Contractor's Responsibilities:
  - (1) Verify mounting and utility requirements for Owner-furnished materials and equipment items.
  - (2) Provide mounting and utility rough in for all items where required.



- (a) Rough in locations, sizes, capacities, and similar type items shall be as indicated and required by product manufacturer.

B. Owner and Installing Contractor(s) Responsibilities:

- (1) Owner-Furnished/Contractor Installed ("OFCI"): Furnished by the Owner; installed by the Installing Contractor.
  - (a) General: Owner and Installing Contractor(s) will coordinate deliveries of materials and equipment to coincide with the construction schedule.
  - (b) Owner will furnish specified materials and equipment delivered to the site. Owner/vendor's representative shall be present on Site at the time of delivery to comply with the contract requirements and Specifications Section 01 43 00, Materials and Equipment, Article 1.04.
  - (c) The Owner furnishing specified materials and equipment is responsible to provide manufacturer guarantees as required by the Contract to the Installing Contractor.
  - (d) The Installing Contractor shall:
    - 1) Review, verify and accept the approved manufacturer's submittal/Shop Drawings for all materials and equipment required to be installed by the Installer Contractor and furnished by the Owner. Any discrepancies, including but not limited to possible space conflicts, should be brought to the attention of the Project Manager and/or Program Manager, if applicable.
    - 2) Coordinate timely delivery. Installing Contractor shall receive materials and equipment at Site when delivered and give written receipt at time of delivery, noting visible defects or omissions; if such declaration is not given, the Installing Contractor shall assume responsibility for such defects and omissions.
    - 3) Store materials and equipment until ready for installation and protect from loss and damage. Installing Contractor is responsible for providing adequate storage space.
    - 4) Coordinate with other bid package contractors and field measurement to ensure complete installation.
    - 5) Uncrate, assemble, and set in place.
    - 6) Provide adequate supports.

- 7) Install materials and equipment in accordance with manufacturer's recommendations, instructions, and Shop Drawings, supply labor and material required, and make mechanical, plumbing, and electrical connections required to operate equipment.
  - 8) Be certified by equipment manufacturer for installation of the specific equipment supplied by the Owner.
  - 9) Provide anchorage and/or bracing as required for seismic restraint per Title 24, UBC Standard 27-11 and all other applicable codes.
  - 10) Provide the contract-required warranty and guarantee for all work, materials and equipment, and installation upon its completion and acceptance by the District. Guarantee includes all costs associated with the removal, shipping to and from the Site, and re-installation of any equipment found to be defective.
- C. Compatibility with Space and Service Requirements:
- (1) Equipment items shall be compatible with space limitations indicated and as shown on the Contract Documents and specified in other sections of the Specifications.
  - (2) Modifications to equipment items required to conform to space limitations specified for rough in shall not cause additional cost to the District.
- D. Manufacturer's printed descriptions, specifications, and instructions shall govern the Work unless specifically indicated or specified otherwise.

## **2.02 FURNISHED MATERIALS AND EQUIPMENT**

- A. All furnished materials and equipment are indicated or scheduled on the Contract Documents.

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION**

- A. Install equipment items in accordance with the manufacturer's instructions.
- B. Set equipment items securely in place, rigidly or flexibly mounted in accordance with manufacturers' directions.
- C. Make electrical and mechanical connections as indicated and required.
- D. Touch-up and restore damaged or defaced finishes to the Owner's satisfaction.

### **3.02 CLEANING AND PROTECTION**

- A. Repair or replace items not acceptable to the Architect or Owner.
- B. Upon completion of installation, clean equipment items in accordance with manufacturer's recommendations, and protect from damage until final acceptance of the Work by the Owner.

END OF DOCUMENT

SECTION 01 66 00

**PRODUCT DELIVERY, STORAGE AND HANDLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Access, Conditions and Requirements;
- B. Special Conditions.

**1.02 PRODUCTS**

- A. Products are as defined in the General Conditions.
- B. Contractor shall not use and/or reuse materials and/or equipment removed from existing Premises, except as specifically permitted by the Contract Documents.
- C. Contractor shall provide interchangeable components of the same manufacturer, for similar components.

**1.03 TRANSPORTATION AND HANDLING**

- A. Contractor shall transport and handle Products in accordance with manufacturer's instructions.
- B. Contractor shall promptly inspect shipments to confirm that Products comply with requirements, quantities are correct, and products are undamaged.
- C. Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

**1.04 STORAGE AND PROTECTION**

- A. Contractor shall store and protect Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Contractor shall store sensitive products in weather-tight, climate-controlled enclosures.
- B. For exterior storage of fabricated Products, Contractor shall place on sloped supports, above ground.
- C. Contractor shall provide off-site storage and protection when Site does not permit on-site storage or protection.

- D. Contractor shall cover products subject to deterioration with impervious sheet covering and provide ventilation to avoid condensation.
- E. Contractor shall store loose granular materials on solid flat surfaces in a well-drained area and prevent mixing with foreign matter.
- F. Contractor shall provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- G. Contractor shall arrange storage of Products to permit access for inspection and periodically inspect to assure Products are undamaged and are maintained under specified conditions.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION Not Used.**

END OF DOCUMENT

**FIELD ENGINEERING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Site Investigation, and Soils Investigation Report;
- B. Special Conditions;
- C. Site-Visit Certification.

**1.02 REQUIREMENTS INCLUDED:**

- A. Contractor shall provide and pay for field engineering services by a California-registered engineer, required for the project, including, without limitations:
  - (1) Survey work required in execution of the Project.
  - (2) Civil or other professional engineering services specified, or required to execute Contractor's construction methods.

**1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEERS:**

Contractor shall only use a qualified licensed engineer or registered land surveyor, to whom District makes no objection.

**1.04 SURVEY REFERENCE POINTS:**

- A. Existing basic horizontal and vertical control points for the Project are those designated on the Drawings.
- B. Contractor shall locate and protect control points prior to starting Site Work and preserve all permanent reference points during construction. In addition Contractor shall:
  - (1) Make no changes or relocation without prior written notice to District and Architect.
  - (2) Report to District and Architect when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
  - (3) Require surveyor to replace Project control points based on original survey control that may be lost or destroyed.

**1.05 RECORDS:**

Contractor shall maintain a complete, accurate log of all control and survey work as it progresses.

**1.06 SUBMITTALS:**

- A. Contractor shall submit name and address of Surveyor and Professional Engineer to District and Architect prior to its/their work on the Project.
- B. On request of District and Architect, Contractor shall submit documentation to verify accuracy of field engineering work, at no additional cost to the District.
- C. Contractor shall submit a certificate signed by registered engineer or surveyor certifying that elevations and locations of improvements are in conformance or nonconformance with Contract Documents.

**PART 2 – PRODUCTS Not Used.**

**PART 3 - EXECUTION**

**3.01 COMPLIANCE WITH LAWS:**

Contractor is responsible for meeting all applicable codes, OSHA, safety and shoring requirements.

**3.02 NONCONFORMING WORK:**

Contractor is responsible for any re-surveying required by correction of nonconforming work.

END OF DOCUMENT

**CUTTING AND PATCHING**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Inspector, Inspections, and Tests, Integration of Work, Nonconforming Work, and Correction of Work, and Uncovering Work;
- B. Special Conditions;
- C. Imported Materials Certification.

**1.02 CUTTING AND PATCHING:**

- A. Contractor shall be responsible for all cutting, fitting, and patching, including associated excavation and backfill, required to complete the Work or to:
  - (1) Make several parts fit together properly.
  - (2) Uncover portions of Work to provide for installation of ill-timed Work.
  - (3) Remove and replace defective Work.
  - (4) Remove and replace Work not conforming to requirements of Contract Documents.
  - (5) Remove Samples of installed Work as specified for testing.
  - (6) Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
  - (7) Attaching new materials to existing remodeling areas – including painting (or other finishes) to match existing conditions.
- B. In addition to Contract requirements, upon written instructions from the District, Contractor shall uncover Work to provide for observations of covered Work in accordance with the Contract Documents; remove samples of installed materials for testing as directed by District; and remove Work to provide for alteration of existing Work.
- C. Contractor shall not cut or alter Work, or any part of it, in such a way that endangers or compromises the integrity of the Work, the Project, or work of others.



### **1.03 SUBMITTALS:**

- A. Prior to any cutting or alterations that may affect the structural safety of Project, or work of others, and well in advance of executing such cutting or alterations, Contractor shall submit written notice to District pursuant to the applicable notice provisions of the Contract Documents, requesting consent to proceed with the cutting or alteration, including the following:
  - (1) The work of the District or other trades.
  - (2) Structural value or integrity of any element of Project.
  - (3) Integrity or effectiveness of weather-exposed or weather-resistant elements or systems.
  - (4) Efficiency, operational life, maintenance or safety of operational elements.
  - (5) Visual qualities of sight-exposed elements.
  
- B. Contractor's Request shall also include:
  - (1) Identification of Project.
  - (2) Description of affected Work.
  - (3) Necessity for cutting, alteration, or excavations.
  - (4) Effects of Work on District, other trades, or structural or weatherproof integrity of Project.
  - (5) Description of proposed Work:
    - (a) Scope of cutting, patching, alteration, or excavation.
    - (b) Trades that will execute Work.
    - (c) Products proposed to be used.
    - (d) Extent of refinishing to be done.
  - (6) Alternates to cutting and patching.
  - (7) Cost proposal, when applicable.
  - (8) The scheduled date the Contractor intends to perform the Work and the duration of time to complete the Work.
  - (9) Written permission of District or other District contractor(s) whose work will be affected.

#### **1.04 QUALITY ASSURANCE:**

- A. Contractor shall ensure that cutting, fitting, and patching shall achieve security, strength, weather protection, appearance for aesthetic match, efficiency, operational life, maintenance, safety of operational elements, and the continuity of existing fire ratings.
- B. Contractor shall ensure that cutting, fitting, and patching shall successfully duplicate undisturbed adjacent profiles, materials, textures, finishes, colors, and that materials shall match existing construction. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the District's decision shall be final.

#### **1.05 PAYMENT FOR COSTS:**

- A. Cost caused by ill-timed or defective Work or Work not conforming to Contract Documents, including costs for additional services of the District, its consultants, including but not limited to the Construction Manager, the Architect, the Project Inspector(s), Engineers, and Agents, will be paid by Contractor and/or deducted from the Contract by the District.
- B. District shall only pay for cost of Work if it is part of the original Contract Price or if a change has been made to the contract in compliance with the provisions of the General Conditions. Cost of Work performed upon instructions from the District, other than defective or nonconforming Work, will be paid by District on approval of written Change Order. Contractor shall provide written cost proposals prior to proceeding with cutting and patching.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS:**

- A. Contractor shall provide for replacement and restoration of Work removed. Contractor shall comply with the Contract Documents and with the Industry Standard(s), for the type of Work, and the Specification requirements for each specific product involved. If not specified, Contractor shall first recommend a product of a manufacturer or appropriate trade association for approval by the District.
- B. Materials to be cut and patched include those damaged by the performance of the Work.

### **PART 3 – EXECUTION**

#### **3.01 INSPECTION:**

- A. Contractor shall inspect existing conditions of the Site and the Work, including elements subject to movement or damage during cutting and patching, excavating and backfilling. After uncovering Work, Contractor shall inspect conditions affecting installation of new products.

- B. Contractor shall report unsatisfactory or questionable conditions in writing to District as indicated in the General Conditions and shall proceed with Work as indicated in the General Conditions by District.

### **3.02 PREPARATION:**

- A. Contractor shall provide shoring, bracing and supports as required to maintain structural integrity for all portions of the Project, including all requirements of the Project.
- B. Contractor shall provide devices and methods to protect other portions of Project from damage.
- C. Contractor shall, provide all necessary protection from weather and extremes of temperature and humidity for the Project, including without limitation, any work that may be exposed by cutting and patching Work. Contractor shall keep excavations free from water.

### **3.03 ERECTION, INSTALLATION AND APPLICATION:**

- A. With respect to performance, Contractor shall:
  - (1) Execute fitting and adjustment of products to provide finished installation to comply with and match specified tolerances and finishes.
  - (2) Execute cutting and demolition by methods that will prevent damage to other Work, and provide proper surfaces to receive installation of repairs and new Work.
  - (3) Execute cutting, demolition excavating, and backfilling by methods that will prevent damage to other Work and damage from settlement.
- B. Contractor shall employ original installer or fabricator to perform cutting and patching for:
  - (1) Weather-exposed surfaces and moisture-resistant elements such as roofing, sheet metal, sealants, waterproofing, and other trades.
  - (2) Sight-exposed finished surfaces.
- C. Contractor shall execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes as shown or specified in the Contract Documents including, without limitation, the Drawings and Specifications.
- D. Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Contractor shall conform to all Code requirements for penetrations or the Drawings and Specifications, whichever calls for a higher quality or more thorough requirement. Contractor shall maintain integrity of both rated and non-rated fire walls, ceilings, floors, etc.

- E. Contractor shall restore Work which has been cut or removed. Contractor shall install new products to provide completed Work in accordance with requirements of the Contract Documents and as required to match surrounding areas and surfaces.
- F. Contractor shall refinish all continuous surfaces to nearest intersection as necessary to match the existing finish to any new finish.

END OF DOCUMENT

**ALTERATION PROJECT PROCEDURES**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Integration of Work, Purchase of Materials and Equipment, Uncovering of Work and Non-conforming Work and Correction of Work and Trenches;
- B. Special Conditions.

**PART 2 - PRODUCTS**

**2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK:**

- A. New Materials: As specified in the Contract Documents including, without limitation, in the Specifications, Contractor shall match existing products, conditions, and work for patching and extending work.
- B. Type and Quality of Existing Products: Contractor shall determine by inspection, by testing products where necessary, by referring to existing conditions and to the Work as a standard.

**PART 3 - EXECUTION**

**3.01 EXAMINATION:**

- A. Contractor shall verify that demolition is complete and that areas are ready for installation of new Work.
- B. By beginning restoration Work, Contractor acknowledges and accepts the existing conditions.

**3.02 PREPARATION:**

- A. Contractor shall cut, move, or remove items as necessary for access to alterations and renovation Work. Contractor shall replace and restore these at completion.
- B. Contractor shall remove unsuitable material not as salvage unless otherwise indicated in the Contract Documents. Unsuitable material may include, without limitation, rotted wood, corroded metals, and deteriorated masonry and concrete. Contractor shall replace materials as specified for finished Work.

- C. Contractor shall remove debris and abandoned items from all areas of the Site and from concealed spaces.
- D. Contractor shall prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.
- E. Contractor shall close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Contractor shall insulate ductwork and piping to prevent condensation in exposed areas. Contractor shall insulate building cavities for thermal and/or acoustical protection, as detailed.

### **3.03 INSTALLATION:**

- A. Contractor shall coordinate Work of all alternations and renovations to expedite completion and to accommodate District occupancy.
- B. Designated Areas and Finishes: Contractor shall complete all installations in all respects, including operational, mechanical work and electrical work.
- C. Contractor shall remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring Products and finishes to original or specified condition.
- D. Contractor shall refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat and square or straight transition to adjacent finishes.
- E. Contractor shall install products as specified in the Contract Documents, including without limitation, the Specifications.

### **3.04 TRANSITIONS:**

- A. Where new Work abuts or aligns with existing, Contractor shall perform a smooth and even transition. Patched Work must match existing adjacent work in texture and appearance.
- B. When finished surfaces are cut so that a smooth transition with new Work is not possible, Contractor shall terminate existing surface along a straight line at a natural line of division and make a recommendation for resolution to the District and the Architect for review and approval.

### **3.05 ADJUSTMENTS:**

- A. Where removal of partitions or walls results in adjacent spaces becoming one, Contractor shall rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- B. Where a change of plane of 1/4 inch or more occurs, Contractor shall submit a recommendation for providing a smooth transition to the District and the Architect for review and approval.

- C. Contractor shall trim and seal existing wood doors and shall trim and paint metal doors as necessary to clear new floor finish and refinish trim as required.
- D. Contractor shall fit Work at penetrations of surfaces.

**3.06 REPAIR OF DAMAGED SURFACES:**

- A. Contractor shall patch or replace portions of existing surfaces, which are damaged, lifted, discolored, or showing other imperfections, in the area where the Work is performed.
- B. Contractor shall repair substrate prior to patching finish.

**3.07 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS:**

- A. Cultivated or planted areas and other surface improvements which are damaged by actions of the Contractor shall be restored by Contractor to their original condition or better, where indicated.
- B. Contractor shall protect and replace, if damaged, all existing guard posts, barricades, and fences.
- C. Contractor shall give special attention to avoid damaging or killing trees, bushes and/or shrubs on the Premises and/or identified in the Contract Documents, including without limitation, the Drawings.

**3.08 FINISHES:**

- A. Contractor shall finish surfaces as specified in the Contract Documents, including without limitations, the provisions of all Divisions of the Specifications.
- B. Contractor shall finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, Contractor shall refinish entire surface to nearest intersections.

**3.09 CLEANING:**

- A. Contractor shall continually clean the Site and the Premises as indicated in the Contract Documents, including without limitation, the provisions in the General Conditions and the Specifications regarding cleaning.

END OF DOCUMENT

**CONTRACT CLOSEOUT AND FINAL CLEANING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of Work;
- B. Special Conditions;
- C. Temporary Facilities and Controls.

**1.02 CLOSEOUT PROCEDURES**

Contractor shall comply with all closeout provisions as indicated in the General Conditions.

**1.03 FINAL CLEANING**

- A. Contractor shall execute final cleaning prior to final inspection.
- B. Contractor shall clean interior and exterior glass and all surfaces exposed to view; remove temporary labels, tape, stains, and foreign substances, polish transparent and glossy surfaces, wax and polish new vinyl floor surfaces, vacuum carpeted and soft surfaces.
- C. Contractor shall clean equipment and fixtures to a sanitary condition.
- D. Contractor shall replace filters of operating equipment.
- E. Contractor shall clean debris from roofs, gutters, down spouts, and drainage systems.
- F. Contractor shall clean Site, sweep paved areas, and rake clean landscaped surfaces.
- G. Contractor shall remove waste and surplus materials, rubbish, and construction facilities from the Site and surrounding areas.

**1.04 ADJUSTING**

Contractor shall adjust operating products and equipment to ensure smooth and unhindered operation.



### **1.05 RECORD DOCUMENTS AND SHOP DRAWINGS**

- A. Contractor shall legibly mark each item to record actual construction, including:
  - (1) Measured depths of foundation in relation to finish floor datum.
  - (2) Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permit surface improvements.
  - (3) Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - (4) Field changes of dimension and detail.
  - (5) Details not on original Contract Drawings
  - (6) Changes made by modification(s).
  - (7) References to related Shop Drawings and modifications.
- B. Contractor will provide one set of Record Drawings to District.
- C. Contractor shall submit all required documents to District and/or Architect prior to or with its final Application for Payment.

### **1.06 INSTRUCTION OF DISTRICT PERSONNEL**

- A. Before final inspection, at agreed upon times, Contractor shall instruct District's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. For equipment requiring seasonal operation, Contractor shall perform instructions for other seasons within six months or by the change of season.
- C. Contractor shall use operation and maintenance manuals as basis for instruction. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Contractor shall prepare and insert additional data in Operation and Maintenance Manual when the need for such data becomes apparent during instruction.
- E. Contractor shall review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

### **1.07 SPARE PARTS AND MAINTENANCE MATERIALS**

- A. Contractor shall provide products, spare parts, maintenance, and extra materials in quantities specified in the Specifications and in Manufacturer's recommendations.

- B. Contractor shall provide District with all required Operation and Maintenance Data at one time. Partial or piecemeal submissions of Operation and Maintenance Data will not be accepted.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**OPERATION AND MAINTENANCE DATA**

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Completion of the Work;
- B. Special Conditions.

**1.02 QUALITY ASSURANCE:**

Contractor shall prepare instructions and data by personnel experienced in maintenance and operation of described products.

**1.03 FORMAT:**

- A. Contractor shall prepare data in the form of an instructional manual entitled "OPERATIONS AND MAINTENANCE MANUAL & INSTRUCTIONS" ("Manual").
- B. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. When multiple binders are used, Contractor shall correlate data into related consistent groupings.
- C. Cover: Contractor shall identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL & INSTRUCTIONS"; and shall list title of Project and identify subject matter of contents.
- D. Contractor shall arrange content by systems process flow under section numbers and sequence of Table of Contents of the Contract Documents.
- E. Contractor shall provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: The content shall include Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Contractor shall provide with reinforced punched binder tab and shall bind in with text; folding larger drawings to size of text pages.

**1.04 CONTENTS, EACH VOLUME:**

- A. Table of Contents: Contractor shall provide title of Project; names, addresses, and telephone numbers of the Architect, any engineers, subconsultants,

Subcontractor(s), and Contractor with name of responsible parties; and schedule of products and systems, indexed to content of the volume.

- B. For Each Product or System: Contractor shall list names, addresses, and telephone numbers of Subcontractor(s) and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Contractor shall mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: Contractor shall supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Contractor shall not use Project Record Documents as maintenance drawings.
- E. Text: Contractor shall include any and all information as required to supplement product data. Contractor shall provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Warranties and Bonds: Contractor shall bind in one copy of each.

#### **1.05 MANUAL FOR MATERIALS AND FINISHES:**

- A. Building Products, Applied Materials, and Finishes: Contractor shall include product data, with catalog number, size, composition, and color and texture designations. Contractor shall provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Contractor shall include Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Contractor shall include product data listing applicable reference standards, chemical composition, and details of installation. Contractor shall provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: Contractor shall include all additional requirements as specified in the Specifications.
- E. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

#### **1.06 MANUAL FOR EQUIPMENT AND SYSTEMS:**

- A. Each Item of Equipment and Each System: Contractor shall include description of unit or system, and component parts and identify function, normal operating characteristics, and limiting conditions. Contractor shall include performance curves, with engineering data and tests, and complete nomenclature, and commercial number of replaceable parts.

- B. Panelboard Circuit Directories: Contractor shall provide electrical service characteristics, controls, and communications.
- C. Contractor shall include color coded wiring diagrams as installed.
- D. Operating Procedures: Contractor shall include start-up, break-in, and routine normal operating instructions and sequences. Contractor shall include regulation, control, stopping, shut-down, and emergency instructions. Contractor shall include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Contractor shall include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Contractor shall provide servicing and lubrication schedule, and list of lubricants required.
- G. Contractor shall include manufacturer's printed operation and maintenance instructions.
- H. Contractor shall include sequence of operation by controls manufacturer.
- I. Contractor shall provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Contractor shall provide control diagrams by controls manufacturer as installed.
- K. Contractor shall provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Contractor shall provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Contractor shall provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Additional Requirements: Contractor shall include all additional requirements as specified in Specification(s).
- O. Contractor shall provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

**1.07 SUBMITTAL:**

- A. Contractor shall submit to the District for review two (2) copies of preliminary draft or proposed formats and outlines of the contents of the Manual within thirty (30) days of Contractor's start of Work.
- B. For equipment, or component parts of equipment put into service during construction and to be operated by District, Contractor shall submit draft

content for that portion of the Manual within ten (10) days after acceptance of that equipment or component.

- C. Contractor shall submit two (2) copies of a complete Manual in final form prior to final Application for Payment. Copy will be returned with Architect/Engineer comments. Contractor must revise the content of the Manual as required by District prior to District's approval of Contractor's final Application for Payment.
- D. Contractor must submit two (2) copies as well as a PDF in searchable and tabbed format in Specification Section order of revised Manual in final form within ten (10) days after final inspection.

**PART 2 – PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT

**WARRANTIES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Warranty/Guarantee Information;
- B. Special Conditions.

**1.02 FORMAT**

- A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size. Warranties will be in Specification Section order and shall also be submitted in PDF Format
- B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.
- C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier; and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the product or work item is specified.
- D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).

**1.03 PREPARATION:**

- A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within ten (10) days after completion of the applicable item or work. Except for items put into use with District's permission, Contractor shall leave date of beginning of time of warranty blank until the date of completion is determined.
- B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.
- C. Contractor shall co-execute submittals when required.

D. Contractor shall retain warranties until time specified for submittal.

**1.04 TIME OF SUBMITTALS:**

- A. For equipment or component parts of equipment put into service during construction with District's permission, Contractor shall submit a draft warranty for that equipment or component within ten (10) days after acceptance of that equipment or component.
- B. Contractor shall submit for District approval all warranties and related documents within ten (10) days after date of completion. Contractor must revise the warranties as required by the District prior to District's approval of Contractor's final Application for Payment.
- C. For items of work delayed beyond date of completion, Contractor shall provide an updated submittal within ten (10) days after acceptance, listing the date of acceptance as start of warranty period.

**PART 2 - PRODUCTS Not Used.**

**PART 3 – EXECUTION Not Used.**

END OF DOCUMENT



**RECORD DOCUMENTS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS AND PROVISIONS:**

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

- A. General Conditions, including, without limitation, Documents on Work;
- B. Special Conditions.

**PART 2 - RECORD DRAWINGS**

**2.01 GENERAL:**

- A. As indicated in the Contract Documents, the District will provide Contractor with one set of reproducible, full size original Contract Drawings.
- B. Contractor shall maintain at each Project Site one set of marked-up plans and shall transfer all changes and information to those marked-up plans, as often as required in the Contract Documents, but in no case less than once each month. Contractor shall submit to the Project Inspector one set of reproducible Project Record Drawings ("As-Builts") showing all changes incorporated into the Work since the preceding monthly submittal. The As-Builts shall be available at the Project Site. The Contractor shall submit reproducible drawings at the conclusion of the Project following review of the blueline prints.
- C. Label and date each Record Drawing "RECORD DOCUMENT" in legibly printed letters.
- D. All deviations in construction, including but not limited to pipe and conduit locations and deviations caused by without limitation Change Orders, Construction Claim Directives, RFI's, and Addenda, shall be accurately and legibly recorded by Contractor.
- E. Locations and changes shall be done by Contractor in a neat and legible manner and, where applicable, indicated by drawing a "cloud" around the changed or additional information.

**2.02 RECORD DRAWING INFORMATION:**

- A. Contractor shall record the following information:
  - (1) Locations of Work buried under or outside each building, including, without limitation, all utilities, plumbing and electrical lines, and conduits.

- (2) Actual numbering of each electrical circuit to match panel schedule.
- (3) Locations of significant Work concealed inside each building whose general locations are changed from those shown on the Contract Drawings.
- (4) Locations of all items, not necessarily concealed, which vary from the Contract Documents.
- (5) Installed location of all cathodic protection anodes.
- (6) Deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
- (7) Locations of underground work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stubouts, invert elevations, etc.
- (8) Sufficient information to locate Work concealed in each building with reasonable ease and accuracy.

In some instances, this information may be recorded by dimension. In other instances, it may be recorded in relation to the spaces in the building near which it was installed.

- B. Contractor shall provide additional drawings as necessary for clarification.
- C. Contractor shall provide reproducible record drawings, made from final Shop Drawings marked "No Exceptions Taken" or "Approved as Noted."
- D. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide electronic copies of the drawings (in PDF format) with one file with all of the sheets and one set of individual sheet files at the conclusion of the Project.

### **PART 3 - RECORD SPECIFICATIONS**

#### **3.01 GENERAL:**

- A. Contractor shall mark each section legibly to record manufacturer, trade name, catalog number, and supplier of each Product and item of equipment actually installed.
- B. After review and approval of the marked-up specifications by the Project Inspector, Contractor shall provide one electronic copy of the specifications (in PDF format) at the conclusion of the Project.

## **PART 4 - MAINTENANCE OF RECORD DOCUMENTS**

### **4.01 GENERAL**

- A. Contractor shall store Record Documents apart from documents used for construction as follows:
  - (1) Provide files and racks for storage of Record Documents.
  - (2) Maintain Record Documents in a clean, dry, legible condition and in good order.
- B. Contractor shall not use Record Documents for construction purposes.

### **PART 5 – PRODUCTS Not Used.**

END OF DOCUMENT

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 01 81 13.71 - SUSTAINABLE DESIGN REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: General requirements and procedures for compliance with 24 CCR 11, California Green Building Standards Code (CALGreen).
  - 1. Some CALGreen requirements depend on product selections and may not be specifically identified as CALGreen requirements. Compliance with CALGreen requirements may be used as one criterion to evaluate substitution requests and comparable product requests.
  - 2. CALGreen project checklists are attached at the end of this Section for information only.
    - a. Some CALGreen requirements depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

1.02 DEFINITIONS

- A. CALGreen: California Green Building Standards Code, including supplements in effect as of date of the Contract Documents unless otherwise indicated.
  - 1. Definitions that are part of CALGreen apply to this Section.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Review CALGreen requirements and action plans for compliance with requirements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect about CALGreen requirements that depend on product selection or product qualities. Document responses as informational submittals.
- B. Submit documentation to enforcing agency for credits that are the responsibility of Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until enforcing agency has made its determination on Project's CALGreen certification application.
  - 1. Document correspondence with review team, as assigned by the enforcing agency, as informational submittals.

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SUSTAINABLE DESIGN  
REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL  
01 81 13.71 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.05 INFORMATIONAL SUBMITTALS

- A. Documentation for adhesives and sealants, indicating VOC content.
- B. Documentation for paints and coatings, indicating VOC content.
- C. Documentation for carpet systems, indicating compliance with emissions testing or certification.
- D. Documentation for composite wood products, indicating compliance with emissions testing or certification.
- E. Documentation for resilient flooring, indicating compliance with emissions testing or certification.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide products and procedures necessary to comply with CALGreen requirements in this Section. Although other Sections may specify some requirements that contribute to referenced CALGreen requirements, determine additional materials and procedures necessary to comply with CALGreen requirements indicated.

2.02 LOW-EMITTING MATERIALS

- A. Adhesives and Sealants:
  - 1. For field applications, adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with VOC content limits of authorities having jurisdiction, or the following VOC content limits:
    - a. Indoor Carpet Adhesives: 50 g/L.
    - b. Carpet Pad Adhesives: 50 g/L.
    - c. Outdoor Carpet Adhesives: 150 g/L.
    - d. Wood Flooring Adhesive: 100 g/L.
    - e. Rubber Floor Adhesives: 60 g/L.
    - f. Subfloor Adhesives: 50 g/L.
    - g. Ceramic Tile Adhesives: 65 g/L.
    - h. VCT and Asphalt Tile Adhesives: 50 g/L.
    - i. Gypsum Board and Panel Adhesives: 50 g/L.
    - j. Cove Base Adhesives: 50 g/L.
    - k. Multipurpose Construction Adhesives: 70 g/L.
    - l. Structural Glazing Adhesives: 100 g/L.
    - m. Single-Ply Roof Membrane Adhesive: 250 g/L.
    - n. Other Adhesive Not Specifically Listed: 50 g/L.

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3186070000

SUSTAINABLE DESIGN  
REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL  
01 81 13.71 - 2

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- o. PVC Welding Compounds: 510 g/L.
  - p. CPVC Welding Compounds: 490 g/L.
  - q. ABS Welding Compounds: 325 g/L.
  - r. Plastic Cement Welding Compounds: 250 g/L.
  - s. Adhesive Primer for Plastic: 550 g/L.
  - t. Contact Adhesive: 80 g/L.
  - u. Special-Purpose Contact Adhesive (Contact Adhesive That Is Used to Bond Melamine Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
  - v. Structural Wood Member Adhesives: 140 g/L.
  - w. Top and Trim Adhesive: 250 g/L.
  - x. Metal-to-Metal Adhesives: 30 g/L.
  - y. Plastic Foam Adhesives: 50 g/L.
  - z. Adhesives for Porous Materials (except Wood): 50 g/L.
  - aa. Wood Glues: 30 g/L.
  - bb. Fiberglass Adhesives: 80 g/L.
  - cc. Architectural Sealants: 250 g/L.
  - dd. Nonmembrane Roof Sealants: 300 g/L.
  - ee. Roadway Sealants: 250 g/L.
  - ff. Single-Ply Roof Membrane Sealants: 450 g/L.
  - gg. Other Sealants: 420 g/L.
  - hh. Sealant Primers for Nonporous Substrates: 250 g/L.
  - ii. Sealant Primers for Porous Substrates: 775 g/L.
  - jj. Modified Bituminous Sealant Primers: 500 g/L.
  - kk. Other Sealant Primers: 750 g/L.
2. Prohibited Ingredients: Adhesives and sealants must not contain the following:
- a. Chloroform.
  - b. Ethylene dichloride.
  - c. Methylene chloride.
  - d. Perchloroethylene.
  - e. Trichloroethylene.
3. Additional Requirements: Comply with additional requirements in CALGreen for aerosol adhesives, and small unit sizes of adhesives, and sealant or caulking compounds.

B. Paints and Coatings:

1. For field applications, paints and coatings shall comply with VOC limits of California Air Resources Board (CARB) Architectural Coatings Suggested Control Measure (SCM) below, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed shall be determined by classifying the coating as flat, nonflat, or nonflat-high gloss coating, based on its gloss.
- a. Flat Coatings: 50 g/L.
  - b. Nonflat Coatings: 100 g/L.
  - c. Nonflat - High Gloss Coatings: 150 g/L.

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SUSTAINABLE DESIGN  
REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL  
01 81 13.71 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

d. Specialty Coatings:

- 1) Aluminum Roof Coatings: 400 g/L.
- 2) Basement Special Coatings: 400 g/L.
- 3) Bituminous Roof Coatings: 50 g/L.
- 4) Bituminous Roof Primers: 350 g/L.
- 5) Bond Breakers: 350 g/L.
- 6) Concrete Curing Compounds: 350 g/L.
- 7) Concrete/Masonry Sealers: 100 g/L.
- 8) Driveway Sealers: 50 g/L.
- 9) Dry-Fog Coatings: 150 g/L.
- 10) Faux Finishing Coatings: 350 g/L.
- 11) Fire-Resistive Coatings: 350 g/L.
- 12) Floor Coatings: 100 g/L.
- 13) Form-Release Compounds: 250 g/L.
- 14) Graphic Arts Coatings (Sign Paints): 500 g/L.
- 15) High-Temperature Coatings: 420 g/L.
- 16) Industrial Maintenance Coatings: 250 g/L.
- 17) Low Solids Coatings: 120 g/L.
- 18) Magnesite Cement Coatings: 450 g/L.
- 19) Mastic Texture Coatings: 100 g/L.
- 20) Metallic Pigmented Coatings: 500 g/L.
- 21) Multi-Color Coatings: 250 g/L.
- 22) Pretreatment Wash Primers: 420 g/L.
- 23) Primers, Sealers, and Undercoaters: 100 g/L.
- 24) Reactive Penetrating Sealers: 350 g/L.
- 25) Recycled Coatings: 250 g/L.
- 26) Roof Coatings: 50 g/L.
- 27) Rust-Preventive Coatings: 250 g/L.
- 28) Shellacs, Clear: 730 g/L.
- 29) Shellacs, Opaque: 550 g/L.
- 30) Specialty Primers, Sealers and Undercoaters: 100 g/L.
- 31) Stains: 250 g/L.
- 32) Stone Consolidants: 450 g/L.
- 33) Swimming Pool Coatings: 340 g/L.
- 34) Traffic Marking Coatings: 100 g/L.
- 35) Tub and Tile Refinish Coatings: 420 g/L.
- 36) Waterproof Membranes: 250 g/L.
- 37) Wood Coatings: 275 g/L.
- 38) Wood Preservatives: 350 g/L.
- 39) Zinc-Rich Primers: 340 g/L.

2. Additional Requirements: Comply with additional requirements in CALGreen for aerosol paints and coatings.

- C. Carpet Systems: All interior carpet materials, including cushion, shall comply with at least one of the following:

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REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL  
01 81 13.71 - 4

3186070000

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SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Carpet and Rug Institute's Green Label Plus program.
  2. VOC-emission limits and testing requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Version 1.2 (CDPH Standard Method v1.2).
- D. Composite Wood Products: Composite wood products used on the interior or exterior of the building shall have formaldehyde emission rates not greater than the following specified by the California Air Resources Board (CARB), Air Toxics Control Measure (ATCM) for Composite Wood, as tested in accordance with ASTM E1333:
1. Hardwood Plywood (Veneer Core and Composite Core): 0.05 ppm.
  2. Particleboard: 0.09 ppm.
  3. Medium-Density Fiberboard More Than 5/16 Inch Thick: 0.11 ppm.
  4. Medium-Density Fiberboard 5/16 Inch or Less in Thickness: 0.13 ppm.
- E. Resilient Flooring Systems: Where resilient flooring is installed, at least 80 percent of floor area receiving resilient flooring shall meet the requirements comply with the following:
1. VOC-emission limits and testing requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Version 1.2 (CDPH Standard Method v1.2).
- F. Acoustical Ceilings and Wall Panels: Acoustical ceilings and wall panels shall comply with VOC-emission limits and testing requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Version 1.2 (CDPH Standard Method v1.2).

### PART 3 - EXECUTION

#### 3.01 CONSTRUCTION IAQ MANAGEMENT

- A. Cover or close openings in ducts and other related air-distribution component openings with tape, plastic, sheet metal, or other approved method before beginning dust-producing operations and maintain until dust-producing operations are complete.
- B. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period, install MERV 8 filter media according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
  1. Replace all air filters immediately prior to occupancy.

### END OF SECTION

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SUSTAINABLE DESIGN  
REQUIREMENTS - CALGREEN  
NON-RESIDENTIAL  
01 81 13.71 - 5



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SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Sections:

1. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.03 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.04 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

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SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.05 FIELD CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.06 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.07 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

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SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.03 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.

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SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain fire watch during and for at least **<Insert number>** hours after flame-cutting operations.
  - 6. Maintain adequate ventilation when using cutting torches.
  - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Adhered Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

### 3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

- B. Burning: Do not burn demolished materials.

### 3.07 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

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SELECTIVE DEMOLITION  
02 41 19 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 03 30 53 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.

1.03 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with ACI 301.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.02 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I. [**Supplement with the following:**]
- B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

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MISCELLANEOUS CAST-IN-PLACE  
CONCRETE  
03 30 53 -

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

C. Water: ASTM C 94/C 94M.

2.03 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.04 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.05 CONCRETE MIXTURES

A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.

2.06 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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MISCELLANEOUS CAST-IN-PLACE  
CONCRETE  
03 30 53 -

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 3 - EXECUTION

3.01 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.02 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

3.03 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

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3186070000

MISCELLANEOUS CAST-IN-PLACE  
CONCRETE  
03 30 53 -



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.04 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.

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MISCELLANEOUS CAST-IN-PLACE  
CONCRETE  
03 30 53 -

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 03 35 03 - CONCRETE SLAB FINISHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete finish requirements for unformed horizontal concrete surfaces. This section supplements requirements of Division 03 Section "Cast-In-Place Concrete."

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Documentation for sealers, indicating VOC content.

B. Product Test Reports:

1. Slip-resistance test reports from qualified independent testing agency.

1.04 QUALITY ASSURANCE

- A. Standards: Comply with the following documents, except where requirements of the contract documents are more stringent:

1. ACI 301.

PART 2 - PRODUCTS

2.01 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:

1. Sealers:

- a. VOC content limits for field applications within the weatherproofing system.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.02 PERFORMANCE REQUIREMENTS

- A. Slip Resistance, Coefficient of Friction: For sealers on walking surfaces, provide products with the following values as determined by testing identical products in accordance with the following:
1. Level Surfaces, Dry and Wet: DCOF of not less than 0.42 in accordance with ANSI A326.3.

2.03 CONCRETE SLAB SEALER

- A. Concrete Slab Sealer: Liquid chemical hardener; enhanced silicate or silicate type.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Curecrete Chemical; Ashford Formula.
    - b. Dayton Superior; Sure Hard Densifier J17.
    - c. Laticrete; L&M Lion Hard.

2.04 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified product that can be applied in thicknesses from a feathered edge to 1/2 inch to match adjacent floor elevations.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ardex; Feather Edge.
    - b. Dayton Superior; Sure Finish.
    - c. Laticrete; Supercap.
  2. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
  5. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ardex.
    - b. Dayton Superior.
    - c. Laticrete.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
5. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.05 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Contraction Joint Filler:
  1. Sealant: As specified in Section 07 92 00.
- B. Concrete Cleaner: Liquid concentrate, biodegradable, heavy-duty cleaner-degreaser compound.

PART 3 - EXECUTION

3.01 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
  1. Apply scratch finish to surfaces as follows:
    - a. To receive concrete floor toppings.
    - b. To receive mortar setting beds for bonded cementitious floor finishes.
    - c. Other surfaces indicated.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  1. Apply float finish to surfaces as follows:
    - a. To receive trowel finish.
    - b. To be covered with fluid-applied or sheet waterproofing,.
    - c. Other surfaces indicated.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  1. Apply trowel finish to surfaces as follows:
    - a. Exposed to view.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- b. To receive concrete sealer.
  - c. To receive polishing.
  - d. To be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage/waterproofing/crack-isolation membrane, paint, or another thin-film-finish coating system.
  - e. Other surfaces as indicated.
2. Finish surfaces to the following Specified Overall Value (SOV) and Minimum Local Value (MLV) tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
- a. Carpeted Floors: Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
  - b. Polished Concrete Floors: Specified overall values of flatness, F(F) 40; and of levelness, F(L) 30; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 20.
  - c. Other Floors at Slabs on Grade: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
  - d. Other Floors at Suspended Slabs: Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
3. F(L) tolerances do not apply to randomly trafficked floor surfaces that are inclined or cambered.
4. F(L) tolerances do not apply to shored, elevated construction after shoring has been removed.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a fine broom.
- 1. Apply trowel and fine broom finish to surfaces as follows:
    - a. To receive ceramic or quarry tile installed by either thickset or thin-set method.
    - b. To receive traffic coatings.
    - c. Exposed interior stair treads/landings, steps, and ramps.
    - d. Other surfaces indicated.
  - 2. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- 1. Apply broom finish to surfaces as follows:
    - a. Exterior concrete platforms, steps, and ramps.
    - b. Other surfaces indicated.
- G. Float and Broom Finish: After applying float finish, begin second floating operation to surfaces when bleed water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations and apply broom finish as follows:
- 1. Apply float and broom finish to surfaces as follows:

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- a. Parking garage slabs and ramps.
2. Apply a fine broom finish at parking garage slabs by drawing a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Apply a coarse broom finish at parking garage ramps and turns by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.02 REPAIRING SLAB SURFACES

#### A. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
  - a. Correct low and high areas.
  - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
  - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
  - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
  - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
  - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
  - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
  - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
  - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
  - d. Place, compact, and finish to blend with adjacent finished concrete.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- e. Cure in same manner as adjacent concrete.
- 8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
  - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - b. Dampen cleaned concrete surfaces and apply bonding agent.
  - c. Place patching mortar before bonding agent has dried.
  - d. Compact patching mortar and finish to match adjacent concrete.
  - e. Keep patched area continuously moist for at least 72 hours.
- B. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- C. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.03 SEALED CONCRETE FLOORS

- A. Concrete Slab Sealer:
  - 1. Apply sealer/finish following manufacturer's printed application instructions; apply single saturation coat.
  - 2. Remove surplus sealer/hardener and rinse according to manufacturer's instructions.
  - 3. Burnishing: Prior to substantial completion, apply light second coat of chemical sealer-hardener material and polish using mild abrasives or brushes in accordance with sealer/hardener manufacturer's recommendations. Buff to even satin sheen.
  - 4. Location: At all interior, exposed slabs subject to pedestrian traffic, unless indicated otherwise.

### 3.04 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
  - 1. Coordinate floor and slab flatness and levelness testing with Owner's testing agency according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 03 48 00 - PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:  
1. Benches.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.  
1. For precast concrete units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for precast concrete units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
- C. Samples for Verification:  
1. For each color and texture of precast concrete required, 4 inches square in size.

1.03 QUALITY ASSURANCE

- A. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Precast Concrete Products."

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of precast concrete to avoid delaying the Work.
- B. Pack, handle, and ship precast concrete units in suitable packs or pallets.  
1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move precast concrete units if required, using dollies with wood supports.  
2. Store precast concrete units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

1.05 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until precast concrete has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Source Limitations for Precast concrete: Obtain each type of precast concrete unit from single source from single manufacturer.

### 2.02 PRECAST CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce precast concrete color indicated.
- B. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required precast concrete textures and colors.
- C. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required precast concrete textures and colors.
- D. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- E. Reinforcement:
  1. Deformed steel bars complying with ASTM A615/A615M, Grade 40. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of precast concrete material.
    - a. Epoxy Coating: ASTM A775/A775M.
    - b. Galvanized Coating: ASTM A767/A767M.
  2. Galvanized-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- F. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 304.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.03 FABRICATION

- A. Reinforce precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- B. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- C. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- D. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
  - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- E. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- F. Discard and replace precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance.

2.04 PRECAST CONCRETE UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Wausau Tile Our Town Benches or comparable product by one of the following:
  - 1. Empire Precast.
  - 2. Outdoor Creations, Inc.
  - 3. QCP Corp.
- B. Precast Concrete Units:
  - 1. Units are manufactured using the manufacturer's selected method.
  - 2. Benches: Sizes, styles, and configurations as indicated on Drawings.
- C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
- D. Fabrication Tolerances:
  - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.

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PRECAST CONCRETE SPECIALTIES  
03 48 00 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
  3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
  4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- E. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of precast concrete units as follows:
1. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.
- F. Colors and Textures: As selected by Architect from manufacturer's full range.

## 2.05 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.
- B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.
- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by precast concrete manufacturer and expressly approved by cleaner manufacturer for use on precast concrete and adjacent masonry materials.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 SETTING ANCHORED PRECAST CONCRETE

- A. Set precast concrete as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

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PRECAST CONCRETE SPECIALTIES  
03 48 00 - 4

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set precast concrete in locations indicated with uniform joints.

3.03 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/4 inch in 10 ft., , or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/4 inch in 10 ft., , or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

3.04 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Precast concrete may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in precast concrete matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean precast concrete as work progresses.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Steel railings.

1.02 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.04 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.05 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.02 STEEL RAILINGS

- A. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.03 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
  - 1. Clearly mark units for reassembly and coordinated installation.
  - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
  - 1. Provide weep holes where water may accumulate.
  - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay
- H. Form changes in direction as follows:
  - 1. As detailed.
- I. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- J. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.04 STEEL AND IRON FINISHES

- A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
  2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
  3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
  4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Perform fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
  2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
  3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
  4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.02 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M with zinc solder or metallizing. Zinc-rich repair paint not permitted.

END OF SECTION

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PIPE AND TUBE RAILINGS  
05 52 13 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

HMC Architects  
3186070000

PIPE AND TUBE RAILINGS  
05 52 13 - 4



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Rough carpentry.

1.02 REFERENCE STANDARDS

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM International:
  - 1. ASTM D 4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
  - 2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
- C. CBC - California Building Code, 2022
- D. California Green Building Standards Code, CALGreen - 2022.
- E. DOC PS 1 - Department of Commerce Product Standard, U. S. Product Standard for Construction and Industrial Plywood.
- F. DOC PS 20 - Department of Commerce Product Standard, American Softwood Lumber Standards.
- G. DOC PS 2 - Department of Commerce Product Standard, U. S. Product Standard for Construction, Performance Standard for Wood-Based Structural-Use Panels.
- H. ANSI A135.4 - Basic Hardboard.
- I. WWPA - Western Lumber Grading Rules 88, Latest Edition, by Western Wood Products Association.
- J. HPVA HP-1 - American National Standard Institute, Hardwood Plywood and Veneer Association.
- K. APA - The Engineered Wood Association. The Construction Guide.
- L. AWWA C1, C2, C3, C9, C27 - American Wood Preservers Association - Manual of Recommended Practice.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- M. AWPA C20 - American Wood Preservers Association Standards, Structural Lumber - Fire-Retardant Treatment by Pressure Process.
- N. WCLIB - West Coast Lumber Inspection Bureau Standard Grading Rules No. 17.
- O. Title 8 - California Code of Regulations, Construction Safety Orders.
- P. ICC - ES - International Code Council Evaluation Service, Inc. Legacy Reports.
- Q. RIS - Redwood Inspection Service, Standard Specifications for Grades of California Redwood Lumber.
- R. Local AQMD - Local Air Quality Management District Regulations.

1.03 SUBMITTALS

- A. Product Data: For the following:
  - 1. Product Data and current ICC Legacy Reports.
- B. Material Certificates.
- C. CALGreen Submittals:
  - 1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.A.

1.04 QUALITY ASSURANCE

- A. California Green Building Standards Code, CALGreen - 2022.
  - 1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
  - 2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
  - 3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.
- B. Rough Carpentry Lumber: Visible grade stamp on all products required.
- C. Grade Stamp: Association under whose rules it was graded, or official grade mark of other recognized grading agencies using grading rules, equivalent to WWPA or WCLIB.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Association performing grading and grade marking of lumber shall be approved by Architect and Division of the State Architect.
- E. Nailing guns and nail operators shall be approved in accordance with Title 8 Construction Safety Orders.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver rough carpentry items until site conditions are adequate to receive the Work. Protect items from weather while in transit.
- B. Store lumber and plywood at the site under cover or otherwise protected against exposure to weather, raise above ground and out of contact with damp or wet surfaces. Stack lumber and plywood and provide for air circulation within and around stacks and under temporary covers. For pressure treated lumber and plywood, provide spacers between courses to permit air circulation.
- C. Install bracing as required. Make proper provision to take care of stresses resulting from construction loads, whenever piles materials, erection equipment or other loads are carried by frame during its erection.

1.06 FIELD CONDITIONS

- A. Cooperate with other trades in coordinating their Work with the Work of this Section. Provide wood grounds, blocking and nailer where indicated or as required for Work of other trades.

PART 2 - PRODUCTS

2.01 ROUGH CARPENTRY MATERIALS

- A. Lumber: Graded in accordance with WWPA or WCLIB; maximum moisture content of 19 percent at time of installation. Provide Douglas Fir Larch for structural and framing lumber, surfaced four sides to standards of the grading association unless otherwise indicated on Drawings, use the following grades:
  - 1. Joists, rafters, beams, lintels, horizontal framing, posts, studs and vertical framing: No. 1 unless otherwise indicated or noted on drawings.
  - 2. Non-bearing studs and plates, non-structural furring, concealed blocking, stripping and miscellaneous nailers and backing: No. 2 unless noted otherwise in the structural drawings.
  - 3. Structural Drawings take precedence for lumber grades.
  - 4. All lumber in contact with concrete shall be pressure treated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Plywood: CBC Section 2303.3 and 2304.6, Douglas Fir 1 Group Species, PS 1, APA Structural I Rated Sheathing. Bond Classification; Exposure 1 plywood grade. Thickness as indicated, span rating sized for spacing.
  - 1. For painted finish for interior and exterior: APA Sanded Plywood Panels, Panel Grade A-C, Group 1, Exterior plywood grade, sanded face, touch sanded back side.
  - 2. Exposure 1 plywood grade: "CDX", Structural I, C-D.
- C. Roof Plywood Decking: requiring FM 1-90 Wind and Fire Classification, minimum 1/2" thick. CBC Section 2304.8, Douglas Fir 1 Group Species, PS 1, APA Structural I Rated Sheathing. Bond Classification: Exposure 1, B-C Veneer Grade, sanded 1 side. Thickness as indicated, span rating sized for spacing.
- D. Board Roof Decking: 2 x 6 Douglass Fir, kiln dry, #1 Grade Lumber, Tongue and Groove, surfaced one side.
- E. Preservative (Pressure) Treated Lumber: Section 2303.1.9 Conform to AWWPA Manual of Recommended Practice, kiln dry after treatment. Use preservative complying with AWWPA C2 lumber and C9 plywood, latest edition. Products NOT containing arsenic or chromium. Conform to AQMD, Local Regulations.
  - 1. Douglas Fir Larch, used as required by Section 2303.1.9.1, CBC, shall conform to the following:
    - a. Lumber shall be WWPA or WCLIB grade stamped.
    - b. Lumber shall be No. 1 grade or better unless indicated otherwise on Drawings.
- F. Plywood Backing Panels - Backboards:
  - 1. Telephone and Electrical Equipment backboards, fixed equipment, cabinets, grab bars, door stops and plates: DOC PS 1, Exposure 1, APA A-C, sanded, Veneer Grade, fire-retardant treated, in thickness indicated or, if not indicated, not less than 5/8-inch nominal thickness. Installed "A" side out for paint finish.

## 2.02 ACCESSORIES

- A. Nails, Spikes and Staples: Section 2304.10 CBC, Galvanized for exterior applications, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application. Comply with Table 2304.10.1. Use common nails only.
- B. Bolts, Nuts, Washers, Lags, Pins and Screws: Section 2304.10 CBC, sized to suit application, galvanized for exterior locations, high humidity locations and treated wood, plain finish for other interior locations. Full diameter body bolts only per ASME B18.2.1(.2) or B18.2.6 for structural applications.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Expansion type or powder actuated type for anchorage to solid concrete.
  - 1. Kwik Bolt TZ2 (KB-TZ2) Concrete Anchor, 3/8- to 3/4-inch diameter, ICC ESR-4266, by Hilti Inc.
- D. Stock Framing Connectors: Types indicated on Drawings, galvanized, with nails fully driven in all holes in each face of connector. Conform to the following.
  - 1. Manufacturers: Simpson Strong Tie Co., Inc., San Leandro, CA.
- E. Non-Stock Framing Connectors: Conform to details.
- F. Nonshrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency for application and a 30 minute working time. Acceptable Manufacturers: Dayton Superior, Miamisburg, OH; Sonneborn, Shakopee, MN; Novex Systems International, Clifton NJ, or equal.
- G. Adhesives: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Adhesives shall comply with Local AQMD and California VOC Regulations.

PART 3 - EXECUTION

3.01 LAYOUT MARKINGS

- A. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

3.02 FRAMING, FURRING AND STRIPPING

- A. Erect wood framing, furring, stripping and nailing members true to lines and levels. Do not deviate from true alignment more than 1/4 inch in 10 feet, non-cumulative.
- B. Construct members of continuous pieces of longest possible lengths.

3.03 PLYWOOD SHEATHING

- A. Thickness as indicated on the Drawings, minimum thickness 1/2 inch.
- B. Boundary Nailing: Not less than 3/8 inch from edge, spaced not more than 6 inches on center, unless noted otherwise on Drawings.
- C. Blocking: Panel edges shall bear on framing members or solid blocking.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100 % CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Minimum Size Vertical Panel: 16 inches wide.
- E. Minimum Size Horizontal Panel: 24 inches wide.
- F. Oriented Strand Board not permitted for shear panels unless indicated on structural drawings.

3.04 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing.
    - b. Space panels 1/8 inch apart at edges and ends.

3.05 HORIZONTAL FRAMING

- A. Bearing: 1-1/2-inch minimum on wood or metal, 3 inches on masonry. Lay framing members with crown up. Members with knots at bottom not permitted.
- B. Lateral Support: Use solid blocking, cross bridging or other approved means.
- C. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

**END OF SECTION**

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 01 30.91 - TILE RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Restoration of exterior ceramic tile assemblies.
- B. Related Sections:
  - 1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.02 QUALITY ASSURANCE

- A. Tile Restortation Specialist Qualifications: Engage an experienced firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers for Setting and Grouting Materials:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ARDEX Americas.
    - b. Custom Building Products.
    - c. Laticrete International, Inc.
    - d. MAPEI Corporation.
- B. Source Limitations for Setting and Grouting Materials: Obtain setting and grouting materials from single manufacturer and aggregate from single source or producer.

2.02 CERAMIC TILE PRODUCTS

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. Ceramic Tile: Vitreous or impervious natural clay or porcelain to match existing.

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TILE RESTORATION  
09 01 30.91 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.03 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
  - 2. Basis of Design: Laticrete International, Inc., "254 Platinum."
  - 3. Subject to compliance with requirements, provide named product or equivalent product by one of the following:
    - a. Custom Building Products.
    - b. MAPEI Corporation.
  - 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.04 GROUT MATERIALS

- A. Grout Colors: Match existing.
- B. High-Performance Tile Grout: ANSI A118.7.
  - 1. Polymer Type: Match existing.

2.05 MISCELLANEOUS MATERIALS

- A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108 for installations indicated.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.02 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with dry-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.[ Comply with ANSI A108.19 for installation of gauged porcelain tile panels.]
- B. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

3.04 RETILING

- A. Remove and replace tile to the following extent:
  - 1. All tile in areas indicated.
  - 2. Joints at locations of the following defects:
    - a. Loose tile.
    - b. Hollow-sounding tile when tapped by metal object.
- B. Notify Architect of unforeseen detrimental conditions including voids in joints, cracks, loose tile units, rotted wood, rusted metal, and other deteriorated items.

3.05 REGROUTING

- A. Rake out and regrout joints to the following extent:

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

Retain first subparagraph below if complete repointing of selected areas is indicated on Drawings.

1. All joints in areas indicated.

Revise first subparagraph below to suit Project.

Retain subparagraph below if spot-repointing of missing and deteriorated joints is required.

2. Joints at locations of the following defects:
  - a. Holes and missing grout.
  - b. Cracks 1/16 inch or more in width and of any depth.
  - c. Hollow-sounding joints when tapped by metal object.
  - d. Eroded surfaces 1/4 inch or more deep.
  - e. Deterioration to point that grout can be easily removed by hand, without tools.
  - f. Joints filled with substances other than grout or sealant.

- B. Do not rake out and regrout joints where not required.

### 3.06 GROUT INSTALLATION

- A. Joints shall be packed full and free of all voids or pits, joints shall not be raked. Clean excess grout and mortar from tile surface with water as work progresses. Clean while mortar is fresh and before it hardens on the surface.

### 3.07 CLEANING AND PROTECTION

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
  1. Remove grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.08 EXTERIOR INSTALLATION SCHEDULE

- A. Exterior Wall Installations:
  1. Ceramic Tile Over Wood or Metal Studs
    - a. TCNA W244E: Wood or metal studs; Cement backer board.

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TILE RESTORATION  
09 01 30.91 - 4

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 1) Mortar: Improved modified dry-set mortar.
- 2) Grout: High-performance grout.

END OF SECTION

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TILE RESTORATION  
09 01 30.91 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 01 90.52 - MAINTENANCE REPAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cleaning, repair, and surface preparation of previously painted interior and exterior substrates.
- B. Related Sections:
  - 1. Division 09 painting Sections for paint materials and systems for new coatings applied over previously painted substrates.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 SEQUENCING AND SCHEDULING

- A. Perform maintenance repainting in the following sequence, which includes work specified in this and other Sections:
  - 1. Dismantle existing surface-mounted objects and hardware except items indicated to remain in place. Tag items with location identification and protect.
  - 2. Verify that temporary protections have been installed.
  - 3. Examine condition of surfaces to be painted.
  - 4. Remove existing paint to the degree required for each substrate and surface condition of existing paint.
  - 5. Apply paint system.
  - 6. Reinstall dismantled surface-mounted objects and hardware unless otherwise indicated.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include recommendations for product application and use.
  - 2. Include test data substantiating that products comply with requirements.

1.05 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified coating system manufacturer's service representative to perform preconstruction testing of cleaning materials, paint removers and compatibility of paint coatings and systems for each type of painted surface.
  - 1. Propose changes to materials and methods to suit Project.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 2 - PRODUCTS

2.01 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F.
- C. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium pyrophosphate (TSPP), 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for every 5 gal. of solution required.
- D. Mildewcide: Commercial proprietary mildewcide or a job-mixed solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.
- E. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation for removing corrosion from iron and steel.

2.02 PAINT REMOVERS

- A. Paint Remover: Paint and coating system manufacturer's recommended paste or gel formulation for removing paint from substrates as required to suit Project; and containing no methylene chloride.

2.03 PAINT MATERIALS

- A. Provide paint products and systems in accordance with Division 09 painting Sections.
- B. Transition Coat: Paint manufacturer's recommended coating for use where a residual existing coating is incompatible with the paint system.

2.04 PATCHING MATERIALS

- A. Wood-Patching Compound: Two-part, epoxy-resin, wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated from weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Metal-Patching Compound: Two-part, polyester-resin, metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated from corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.
- C. Cementitious Patching Compounds: Cementitious patching compounds and repair materials specifically manufactured for filling cementitious substrates and for sanding or tooling prior to repainting; formulation as recommended in writing by manufacturer for type of cementitious substrate indicated, exposure to weather and traffic, the detail of work, and site conditions.
- D. Gypsum-Plaster Patching Compound: Finish coat plaster and bonding compound according to ASTM C842 and manufacturer's written instructions.

### PART 3 - EXECUTION

#### 3.01 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  - 1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless the solutions will not damage adjacent surfaces. Use protective materials that are UV resistant and waterproof. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  - 2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
  - 3. Neutralize and collect alkaline and acid wastes before disposal.
  - 4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

#### 3.02 MAINTENANCE REPAINTING, GENERAL

- A. Execution of the Work: In repainting surfaces, disturb them as minimally as possible and as follows:
  - 1. Remove failed coatings and corrosion and repaint.
  - 2. Verify that substrate surface conditions are suitable for repainting.
  - 3. Allow other trades to repair items in place before repainting.

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MAINTENANCE REPAINTING  
09 01 90.52 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle methods, such as scraping and lightly hand sanding, that will not abrade softer substrates, reducing clarity of detail.
- C. Heat Processes: Do not use torches, heat guns, or heat plates.

3.03 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of painting work. Comply with paint manufacturer's written instructions for inspection.
- B. Maximum Moisture Content of Substrates: Do not begin application of coatings unless moisture content of exposed surface is below the maximum value recommended in writing by paint manufacturer and not greater than the following maximum values when measured with an electronic moisture meter appropriate to the substrate material:
  - 1. Concrete: 12 percent.
  - 2. Gypsum Board: 12 percent.
  - 3. Masonry (Clay and CMU): [12] <Insert number> percent.
  - 4. Portland Cement Plaster: 12 percent.
  - 5. Wood: 15 percent.
- C. Alkalinity: Do not begin application of coatings unless surface alkalinity is within range recommended in writing by paint manufacturer. Conduct alkali testing with litmus paper on exposed plaster, cementitious, and masonry surfaces.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
  - 1. If existing surfaces cannot be prepared to an acceptable condition for proper finishing by using specified surface-preparation methods, notify Architect in writing.
- E. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.04 PREPARATORY CLEANING

- A. General: Use the gentlest, appropriate method necessary to clean surfaces in preparation for painting. Clean all surfaces, corners, contours, and interstices.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
- C. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.
- D. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
- E. Chemical Rust Removal:
  - 1. Remove loose rust scale with specified abrasives for ferrous-metal cleaning.
  - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
  - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
  - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
  - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
  - 6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- F. Mechanical Rust Removal:
  - 1. Remove rust with specified abrasives for ferrous-metal cleaning. Clean to bright metal.
  - 2. Wipe off residue with mineral spirits and either steel wool or soft rags.
  - 3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
  - 4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

### 3.05 PAINT REMOVAL

- A. General: Remove paint where indicated and where required by coating system manufacturer. Where cleaning methods have been attempted and further removal of the paint is required because of incompatible or unsatisfactory surfaces for repainting, remove paint to extent required by conditions.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Application: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
    - a. Apply materials to all surfaces, corners, contours, and interstices, to provide a uniform final appearance without streaks.
    - b. After work is complete, remove protection no longer required. Remove tape and adhesive marks.
  2. Brushes: Use brushes that are resistant to chemicals being used.
    - a. Metal Substrates: If using wire brushes on metal, use brushes of same metal composition as metal being treated.
    - b. Wood Substrates: Do not use wire brushes.
  3. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
    - a. Equip units with pressure gages.
    - b. Unless otherwise indicated, hold spray nozzle at least 6 inches from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
    - c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with nozzle having a cone-shaped spray.
    - d. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
    - e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
- B. Paint Removal with Hand Tools: Remove paint manually using hand-held scrapers, wire brushes, sandpaper, and metallic wool as appropriate for the substrate material.
- 3.06 SUBSTRATE REPAIR
- A. General: Repair substrate surface defects that are inconsistent with the surface appearance of adjacent materials and finishes.
  - B. Wood Substrate:
    1. Repair wood defects including dents and gouges more than 1/4 inch in size and all holes and cracks by filling with wood-patching compound and sanding smooth. Reset or remove protruding fasteners.
    2. Where existing paint is allowed to remain, sand irregular buildup of paint, runs, and sags to achieve a uniformly smooth surface.
  - C. Cementitious Material Substrate:
    1. General: Repair defects including dents and chips more than 1/2 inch in size and all holes and cracks by filling with cementitious patching compound and sanding smooth. Remove protruding fasteners.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. New and Bare Plaster: Neutralize surface of plaster with mild acid solution as recommended in writing by paint manufacturer. In lieu of acid neutralization, follow manufacturer's written instruction for primer or transition coat over alkaline plaster surfaces.
3. Concrete, Cement Plaster, and Other Cementitious Products: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. If surfaces are too alkaline to paint, correct this condition before painting.

D. Gypsum-Board Substrates:

1. Repair defects including dents and chips more than 1/4 inch in size and all holes and cracks by filling with gypsum-plaster patching compound and sanding smooth. Remove protruding fasteners.
2. Rout out surface cracks to remove loose, unsound material; fill with patching compound and sand smooth.

E. Metal Substrates:

1. Preparation: Treat repair locations by wire-brushing and solvent cleaning. Use mechanical rust removal method to clean off rust.
2. Defects in Metal Surfaces: Repair non-load-bearing defects in existing metal surfaces, including dents and gouges more than 1/8 inch deep or 1/2 inch across and all holes and cracks by filling with metal-patching compound and sanding smooth. Remove burrs and protruding fasteners.
3. Priming: Prime iron and steel surfaces immediately after repair to prevent flash rusting. Stripe paint corners, crevices, bolts, welds, and sharp edges. Apply two coats to surfaces that are inaccessible after completion of the Work.

3.07 PAINT APPLICATION, GENERAL

- A. Comply with manufacturers' written instructions for application methods unless otherwise indicated in this Section.
- B. Prepare surfaces to be painted according to the Surface-Preparation Schedule and with manufacturer's written instructions for each substrate condition.
- C. Apply a transition coat over incompatible existing coatings.
- D. Metal Substrate: Stripe paint corners, crevices, bolts, welds, and sharp edges before applying full coat. Apply two coats to surfaces that are inaccessible after completion of the Work. Tint stripe coat different than the main coating and apply with brush.
- E. Blending Painted Surfaces: When painting new substrates patched into existing surfaces or touching up missing or damaged finishes, apply coating system specified for the specific substrate. Apply final finish coat over entire surface from edge to edge and corner to corner.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.08 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage manufacturer's service representative for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

3.09 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Acoustical panels installed in existing suspension systems for interior ceilings.

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 1 percent of quantity installed, but not less than eight of each specified size, style and color.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  - 1. Ceiling Products:
    - a. VOC emissions testing or certification.

2.03 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Acoustical lay-in panel ceiling systems shall comply with the Division of the State Architect (DSA) Interpretation of Regulations (IR) 25-2.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E1264.
  - 2. Smoke-Developed Index: 50 or less.

2.04 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

B. Basis-of-Design Product: As indicated on Drawings.

2.05 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  - 2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.02 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 65 00 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resilient tile flooring.

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.
2. Section 09 65 13 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: For each type of resilient flooring, in manufacturer's standard size, but not less than 2-by-5-inch sections of each color, texture, and pattern required.

1.03 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Documentation for adhesives , indicating VOC content.
2. Documentation for flooring products, indicating compliance with emissions testing or certification.

B. Qualification Data: For Installer.

C. Product Test Reports:

1. Slip-resistance test reports from qualified independent testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient flooring to include in maintenance manuals.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient flooring installation and seaming method indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.
    - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient flooring during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient flooring installation.
- D. Close spaces to traffic for 48 hours after resilient flooring installation.
- E. Install resilient flooring after other finishing operations, including painting, have been completed.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 2 - PRODUCTS

2.01 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
1. Adhesives:
    - a. VOC content limits for field applications.
  2. Sealants:
    - a. VOC content limits for field applications.
  3. Flooring Products:
    - a. VOC emissions testing or certification.

2.02 PERFORMANCE REQUIREMENTS

- A. Slip Resistance, Coefficient of Friction: Provide products with the following values as determined by testing identical products in accordance with the following:
1. Level Surfaces, Dry and Wet: DCOF of not less than 0.42 in accordance with ANSI A326.3.
- B. Fire-Test-Response Characteristics: For resilient flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
  2. Smoke Density: 450 or less in accordance with ASTM E662 and NFPA 258.

2.03 RESILIENT TILE FLOORING

- A. Solid Vinyl Floor Tile:
1. Tile Standard: ASTM F1700.
    - a. Class: As indicated by product designations on drawings.
    - b. Type: As indicated by product designations on drawings.
  2. Thickness: As indicated by product designations.
  3. Size: As indicated by product designations on drawings .
  4. Colors and Patterns: As indicated by manufacturer's designations on drawings.
- B. Rubber Floor Tile (RBRT):
1. Tile Standard: ASTM F1344.
  2. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer according to ASTM D2240.
  3. Wearing Surface: As indicated by manufacturer's designations on drawings.
  4. Thickness: As indicated by manufacturer's designations on drawings.
  5. Size: As indicated by manufacturer's designations on drawings.
  6. Colors and Patterns: As indicated by manufacturer's designations on drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.04 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient flooring and substrate conditions indicated.
- C. High Performance Adhesives: Type recommended by manufacturer where heavy static or rolling loads exist.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to resilient flooring manufacturer's written instructions to ensure adhesion of resilient flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient flooring manufacturer. Do not use solvents.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient flooring until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient flooring.

### 3.03 RESILIENT FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient flooring.
- B. Unroll resilient flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient flooring as follows:
  - 1. Maintain uniformity of flooring direction.
  - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
  - 3. Match edges of flooring for color shading at seams.
  - 4. Avoid cross seams.
- D. Scribe and cut resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere resilient flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.04 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles in pattern of colors and sizes indicated.
  - 2. Alternate direction of tile pattern for each abutting tile in line. Fit tightly and accurately to vertical surface, floor plates, thresholds and edging strips with clean cuts.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere non-self-adhering floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.05 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient flooring.
- B. Perform the following operations immediately after completing resilient flooring installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient flooring until Substantial Completion.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient accessories.
3. Resilient molding accessories.

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

1.03 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Documentation for adhesives, indicating VOC content.
2. Documentation for resilient base and resilient stair accessories, indicating compliance with emissions testing or certification.

B. Product Test Reports:

1. Slip-resistance test reports from qualified independent testing agency.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. Slip Resistance, Coefficient of Friction: Provide resilient stair products on walking surfaces with the following values as determined by testing identical products in accordance with the following:
  1. Level Surfaces, Dry and Wet: DCOF of not less than 0.42 in accordance with ANSI A326.3.

### 2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Johnsonite.
  2. Mannington Commercial / Burke.
  3. Roppe.

### 2.03 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  1. Adhesives:
    - a. VOC content limits for field applications.
  2. Resilient Base and Resilient Stair Accessories:
    - a. VOC emissions testing or certification.

### 2.04 RESILIENT BASE

- A. Product Standard: As follows:
  1. ASTM F1861, Type TP (rubber, thermoplastic).
- B. Style and Location:
  1. As indicated on drawings.
- C. Thickness: 0.125 inch.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length. Cut lengths 48 inches long not permitted.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated by manufacturer's designations .

2.05 STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Stair Treads: ASTM F2169.
  - 1. Basis-of-Design Product: As indicated on drawings.
  - 2. Type: TP (rubber, thermoplastic) .
  - 3. Class: 1 (smooth, flat).
  - 4. Group: 1 (embedded abrasive strips) 2 (with contrasting color for the visually impaired).
  - 5. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
  - 6. Nosing Height: 1-1/2 inches.
  - 7. Thickness: 1/4 inch and tapered to back edge.
  - 8. Size: Lengths and depths to fit each stair tread in one piece.
  - 9. Integral Risers: Smooth, flat; in height that fully covers substrate.
- C. Stringers: Height and length after cutting to fit risers and treads and to cover stair stringers, produced by same manufacturer as treads, and recommended by manufacturer for installation with treads.
  - 1. Thickness: Manufacturer's standard.
- D. Locations: Provide rubber stair accessories in areas indicated.
- E. Colors and Patterns: As indicated by manufacturer's designations.

2.06 MOLDING ACCESSORIES

- A. Description: Provide rubber molding accessories as follows:
  - 1. As indicated on drawings.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide rubber molding accessories in areas indicated.

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RESILIENT BASE AND ACCESSORIES  
09 65 13 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Colors and Patterns: As indicated by manufacturer's designations.

2.07 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to manufacturer's instructions and ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate. Gaps between resilient base and substrates not permitted.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.03 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
  1. With top set gauge, remove portion of back side of base to the bend. Make two relief cuts, one on each side of the bend at the bottom of the base. Remove a tapered piece from the bottom of the toe. Attach per manufacturer's instructions.
  2. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  3. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter corners to minimize open joints.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.04 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
  - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
  - 4. Visually align tread pattern at each stair run.
- C. Stair Stringers: Carefully cut and fit tight to stair risers and treads with top and bottom edges in firm, full contact with floor and wall, and entire backside bonded to wall.
- D. Stair Angles Trim: Carefully cut and fit tight to stair and landing edges, where occurs
- E. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.
  - 1. Apply three coat(s).
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Resinous flooring systems.
- B. Related Sections:
  - 1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of exposed finish required.

1.03 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for floor coatings, indicating VOC content.
- B. Product Test Reports:
  - 1. Slip-resistance test reports from qualified independent testing agency.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.
- B. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each demonstration and training.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

## PART 2 - PRODUCTS

### 2.01 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  - 1. Floor Coatings:
    - a. VOC content limits for field applications.

### 2.02 PERFORMANCE REQUIREMENTS

- A. Slip Resistance, Coefficient of Friction: Provide products with the following values as determined by testing identical products in accordance with the following:
  - 1. Level Surfaces, Dry and Wet: DCOF of not less than 0.42 in accordance with ANSI A326.3.
- B. Flammability: Self-extinguishing according to ASTM D635 and in compliance with the following:
  - 1. CBC 804.2, 804.4.

### 2.03 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

### 2.04 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:
    - a. BASF Corporation.
    - b. Crossfield Products Corp.
    - c. Duraflex, Inc.
    - d. Stonhard, Inc.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. System Characteristics:
  - 1. Color and Pattern: As selected by Architect from manufacturer's full range.
  - 2. Wearing Surface: Manufacturer's standard slip resistant wearing surface.
  - 3. Overall System Thickness: As indicated by product designation.
- C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
  - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

#### 3.02 INSTALLATION

- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
  - C. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
  - D. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions. Round internal and external corners.
  - E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness indicated for flooring system.
    - 1. Aggregates: Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
  - F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
  - G. Grout Coat: Apply grout coat(s), of type and number recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
  - H. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.
  - I. Protect resinous flooring from damage and wear during the remainder of construction period.
- 3.03 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to repair resinous flooring.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.
2. Section 02 41 19 "Selective Demolition" for removing existing floor coverings.
3. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
4. Section 09 68 16 "Sheet Carpeting" for carpet roll goods.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- E. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.03 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for adhesives, indicating VOC content.
  - 2. Documentation for flooring products, indicating compliance with emissions testing or certification.
  - 3. Documentation for recycled content of nylon carpet, indicating postconsumer and preconsumer recycled content and cost.
- B. Qualification Data: For Installer.
- C. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.08 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.09 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.
    - e. Loss of face fiber.
    - f. Delamination.
  - 3. Warranty Period: Lifetime limited.

PART 2 - PRODUCTS

2.01 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  - 1. Adhesives:
    - a. VOC content limits for field applications.
  - 2. Flooring Products:
    - a. VOC emissions testing or certification.
    - b. Compliance with sustainable design criteria for material sourcing will require the following:

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 1) Carpet, Nylon: Minimum 10 percent total recycled content with minimum 10 percent post-consumer recycled content.

2.02 CARPET TILE

- A. Products: As indicated on drawings.
- B. Performance Characteristics:
  1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
  2. Optical Smoke Density Rating: Does not exceed 450 according to ASTM E662.

2.03 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Wood Subfloors: Verify the following:
  1. Underlayment over subfloor complies with requirements specified in Section 06 16 00 "Sheathing."
  2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.02 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 68 16 - SHEET CARPETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Tufted carpet.

B. Related Requirements:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.
2. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics and durability.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Types, colors, and locations of insets and borders.
10. Types, colors, and locations of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.
12. Type of carpet cushion.

C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- square Sample.

D. Product Schedule: For carpet. Use same designations indicated on Drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.03 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for adhesives, indicating VOC content.
  - 2. Documentation for adhesives, indicating compliance with emissions testing or certification.
  - 3. Documentation for flooring products, indicating compliance with emissions testing or certification.
- B. Qualification Data: For Installer.
- C. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.07 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.08 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, the following:
    - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    - b. Loss of tuft bind strength.
    - c. Excess static discharge.
    - d. Delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TUFTED CARPET

- A. Products: As indicated on drawings.
- B. Performance Characteristics:
  - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
  - 2. Optical Smoke Density Rating: Does not exceed 450 according to ASTM E662.

2.02 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Seam Adhesive: Product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance.
- B. Examine carpet for type, color, pattern, and potential defects.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Concrete Slabs: Verify that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Wood Subfloors: Verify the following:
  - 1. [Underlayment over subfloor complies with requirements specified in Division 06 Section "Sheathing."]
  - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.03 INSTALLATION

- A. Comply with the Carpet and Rug Institute's CRI 104 and carpet manufacturer's written installation instructions for the following:
  - 1. Preapplied adhesive installation.
- B. Comply with carpet manufacturer's written instructions and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Install borders with mitered corner seams.
- D. Do not bridge building expansion joints with carpet.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess seam sealer and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Surface preparation and the application of paint systems on interior and exterior substrates.
- B. Related Sections:
  - 1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 DEFINITIONS

- A. Sheen Levels:
  - 1. Flat: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
  - 2. Eggshell: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
  - 3. Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
  - 4. Semi-Gloss: 35 to 70 units at 60 degrees, according to ASTM D523.
  - 5. Gloss: 70 units and greater at 60 degrees, according to ASTM D523.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.

1.04 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for paints and coatings, indicating VOC content.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.05 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 3 articles for the paint category indicated.
- B. Source Limitations: Obtain products for each coating system from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
1. Paints and Coatings:
    - a. VOC content limits for field applications.

2.03 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated in Drawings.

HMC Architects  
3186070000

PAINTING  
09 91 00 - 2

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Fiber-Cement Board: 12 percent.
  - 3. Masonry (Clay and CMUs): 12 percent.
  - 4. Wood: 15 percent.
  - 5. Gypsum Board: 12 percent.
  - 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates:
  - 1. Metal Substrates Galvanized in Accordance with ASTM A 123 and ASTM A 153: Prepare substrates in accordance with ASTM D 6386.
  - 2. Other Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.03 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.
    - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
  - 2. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.04 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

### 3.05 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

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PAINTING  
09 91 00 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Wrapped Ducts, and ACT in Multi-Purpose Room:
1. Spot Prime Coat as needed: Primer, acrylic, Dunn-Edwards, Ultra-Grip Select UGSL00.
  2. Intermediate Coat: Latex, interior, matching topcoat.
  3. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Aquafall Dry Fall Paint AQUA30, (Gloss Level 3).
- B. Gypsum Board Walls and Wood Trimmed ACT above Wainscot in Multipurpose Room:
1. Spot Prime as needed: Primer, acrylic, Dunn-Edwards, Ultra-Grip Select UGSL00.
  2. Full Prime Wood Trim: Primer, acrylic, Dunn-Edwards, Ultra-Grip Select UGSL00.
  3. Intermediate Coat: Latex, interior, matching topcoat.
  4. Topcoat: Waterborne urethane alkyd, interior/exterior, eggshell, Dunn-Edwards, Aristoshield ASHL30, (Gloss Level 3).
- C. MDF or fiberboard Wainscot Multi-Purpose Room:
1. Full Prime Coat: Primer, acrylic, Dunn-Edwards, Ultra-Grip Select UGSL00.
  2. Intermediate Coat: Latex, interior, matching topcoat.
  3. Topcoat: Waterborne urethane alkyd, interior/exterior, eggshell, Dunn-Edwards, Aristoshield ASHL30, (Gloss Level 3).
- D. Paint over Vinyl Wallcovering in Office Space:
1. Prime Coat: Primer, acrylic, Zinsser, Gardz Problem Surface Sealer GDZ-01.
  2. Intermediate Coat: Latex, interior, matching topcoat.
  3. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Everest Interior Eggshell Paint EVER30 (Gloss Level 3).
- E. Stained or Clear Coated Wood Doors in Multi-Purpose Room:
1. Intermediate Coat: Old Masters, Masters Armor Interior Water-Based Clear Finish, Satin 72101.
  2. Topcoat: Old Masters, Masters Armor Interior Water-Based Clear Finish, Satin 72101.
- F. Hollow Metal Doors and Door Frames:
- a. Ultra-Premium Low Odor / Zero VOC Latex over a Waterborne Alkyd Primer System:
    - 1) Spot Prime Coat: Primer, alkyd, anti-corrosive, for metal, Dunn-Edwards, Bloc-Rust Premium BRPR00 Series.
    - 2) Intermediate Coat: Latex, interior, matching topcoat.

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PAINTING  
09 91 00 - 6

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 3) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

All systems below meet LEED requirements for VOC limits, Rustoleum and Sherwin Williams are both Zero VOC:

### 3.07 EXTERIOR PAINTING SCHEDULE

#### A. Cement Plaster

1. Prime Coat: Primer, alkali and crack resistant, Dunn-Edwards, Flex-Prime Select, Interior/Exterior Flexible Masonry Primer (FPSL00).
2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, Dunn-Edwards, Evershield, EVSH30, 100% acrylic, (Gloss Level 3).

#### B. Wood Substrates:

1. Spot Prime Coat: Primer, water based, exterior, Dunn-Edwards, Ultra-Grip Select UGSL00).
2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, Dunn-Edwards, Evershield, EVSH30, 100% acrylic, (Gloss Level 3).

#### C. Ferrous Metal Flashing Trim Steel Accents Reveals Castiron Pipes and downspouts Metal Doors and Hollow Metal Window Frames:

##### a. Waterborne Urethane Alkyd Enamel System:

- 1) Spot Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Bloc-Rust Premium BRPR00 Series.
- 2) Full Prime Coat: As needed for chalky surfaces. Super-Loc bonding primer (SLPR00).
- 3) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
- 4) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

#### D. Metal Handrails:

##### a. Waterborne Urethane Alkyd Enamel System:

- 1) Spot Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Bloc-Rust Premium BRPR00 Series.
- 2) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
- 3) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

#### E. Metal Fences and Gates:

##### a. Waterborne Urethane Alkyd Enamel System:

- 1) Spot Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Bloc-Rust Premium BRPR00 Series.

HMC Architects  
3186070000

PAINTING  
09 91 00 - 7



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 2) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
- 3) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

F. Galvanized Metal Handrails:

- a. Waterborne Urethane Alkyd Enamel System:
  - 1) Spot Prime exposed metal: Ultrashield Galvanized Metal Primer (ULGM00).
  - 2) Full Prime: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Super-Loc bonding primer (SLPR00).
  - 3) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
  - 4) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

G. Aluminum Window Frames:

- a. Waterborne Urethane Alkyd Enamel System:
  - 1) Spot Prime Exposed Metal: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Ultrashield Galvanized Metal Primer ULGM00.
  - 2) Full Prime: As needed for chalky surfaces. Dunn-Edwards Super-Loc Premium Interior/Exterior Masonry Bonding Primer SLPR00.
  - 3) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
  - 4) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5).

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Dimensional characters.
  2. Panel signs.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
1. Include fabrication and installation details and attachments to other work.
  2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign.
  4. Provide scaled drawings and signage schedule for each sign indicating materials, lettering layout, and colors.
  5. Provide large-scale drawings and details of custom logo and lettering including mounting details.
    - a. Include plans, elevations, and large-scale sections of typical members and other components.
    - b. Show mounting methods, grounds, mounting heights, layout, spacing, spacing, reinforcing, accessories and installation details.
  6. Include font style. 18 point graphical example of alphabet and numerical numbers 0 through 9 of signage font style, upper and lower case letters, punctuation, 18 point scale, and black text on white paper.
- C. Samples: For each exposed product and for each color and texture specified. Illustrating full size sample sign with tactile characters, Braille and subsurface text or pictogram to demonstrate fabrication technique and Braille measurements which shall be used on proposed project.
- D. Dimensional character samples: one full-size representative samples of each dimensional character type required, showing letter style, color and material finish and mounting method.
- E. Product Schedule: For signs. Use same designations indicated on Drawings or specified.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" 2022 California Building Code, Chapter 11B-703.

2.02 DIMENSIONAL CHARACTERS

- A. Cast Characters : Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. A.R.K. Ramos.
    - b. ACE Sign Systems, Inc.
    - c. ASI Sign Systems, Inc.
    - d. Cosco.
    - e. Gemini Signage; Gemini, Inc.
    - f. Matthews International Corporation; Bronze Division.
    - g. Metal Arts.
    - h. Metallic Arts.
    - i. Southwell Company (The).
  - 2. Character Material: Cast aluminum.
  - 3. Character Height: As indicated on Drawings.
  - 4. Finishes:
    - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as indicated by manufacturer's designation .
    - b. Overcoat: Manufacturer's standard baked-on clear coating.
  - 5. Mounting: Manufacturer's standard, recommended mounting method.

2.03 PANEL SIGNS

- A. ADA Tactile and Braille Panel Signs: Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Basis-of-Design Product: Gravotac; GTAC-INT.
  - 2. Sign Material: Laminated sandblasted polymer.
  - 3. Sign-Panel Perimeter: Finish edges smooth.
    - a. Edge Condition: Square cut.
    - b. Corner Condition in Elevation: Square.

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3186070000

SIGNAGE  
10 14 00 - 2

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

4. ADA Tactile: Manufacturer's standard process for producing copy complying with CBC and ADA Accessibility Guidelines. Text shall be accompanied by California Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks, permanently fused to substrate.
  - a. Raised-Copy Thickness: Not less than 1/32 inch.
5. Frame: Entire perimeter.
  - a. Material: Aluminum.
  - b. Profile: Square.
  - c. Corner Condition in Elevation: Square.
  - d. Finish and Color: Painted, matte black color.
6. Unframed Signs: Sized as required for text or room number.
7. Mounting: Manufacturer's standard method for substrates indicated with unless indicated otherwise.

- B. Non-Tactile Signs: Cast Acrylic Plastic Sheet; ASTM D4802 Category A-1, 1/4 inch overall thickness, laminated acrylic plastic sheets, Sub-surface Screened process graphics and symbols, exterior-grade at exterior locations, 3/8 inch radius corners, eased edge, drilled holes for countersunk screws, polished edges.
1. Basis-of-Design Manufacturer: Gravotac.
  2. Frame: Entire perimeter.
    - a. Material: Aluminum.
    - b. Profile: Square.
    - c. Corner Condition in Elevation: Square.
    - d. Finish and Color: Painted, matte black color.
  3. Unframed Signs: Sized as required for text or room number.
  4. Apply UV inhibitor overcoat for exterior signs.
  5. Mounting: Manufacturer's standard method for substrates indicated with unless indicated otherwise.

#### 2.04 SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Zinc Sheet: ASTM B69, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D4802, Type UVF (UV filtering).
- D. Polycarbonate Sheet: Coated, mar-resistant, UV-stabilized polycarbonate, with coating on both sides.
- E. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.05 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
  3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  4. Sign Mounting Fasteners:
    - a. Screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive meeting ASTM C834. Double face adhesive tape not permitted.
- B. Adhesive: As recommended by sign manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions & the requirement in CBC 11B-703.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Accessible Signage: Install in locations on walls as indicated on Drawings according to the accessibility standard & CBC.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Corner guards.
- B. Related Sections:
  - 1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
  - 2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

1.03 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
  - 1. Documentation for adhesives, indicating VOC content.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:

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WALL AND DOOR PROTECTION  
10 26 00 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Adhesives:
  - a. VOC content limits for field applications.

## 2.03 CORNER GUARDS

- A. Surface-Mounted, Opaque-Plastic Corner Guards: Fabricated as one piece from PVC plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
  1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in drawings.
  2. Wing Size: As indicated on drawings .
  3. Mounting: Adhesive.
  4. Color and Texture: As selected by Architect from manufacturer's full range.
- B. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
  1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in drawings.
  2. Material: Stainless-steel sheet, Type 304.
    - a. Thickness: Minimum 0.0500 inch.
    - b. Finish: Directional satin, No. 4.
  3. Wing Size: As indicated on drawings.
  4. Corner Radius: 1/8 inch.
  5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.03 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

3.04 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Washroom accessories.

1.02 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
  2. Identify accessories using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated or comparable products by one of the following:
1. ASI-American Specialties, Inc.
  2. Bobrick Washroom Equipment, Inc.
  3. Bradley Corporation.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Soap Dispenser:
  - 1. Basis-of-Design Product: #91628, Black Proline Curve Dispenser Green Tip.

- C. Mirror Unit:
  - 1. Basis-of-Design Product: Bobrick; B-290.
  - 2. Frame: Stainless steel angle, 0.05 inch thick .
    - a. Corners: Manufacturer's standard.
  - 3. Size: 24 inches by 36 inches long.

## 2.02 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.
- C. Master key all accessories.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Contractor shall install all necessary blocking, backing, and recessed openings for all toilet accessories.

### 3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 11 61 43 - STAGE CURTAINS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Stage curtains, scrims, and drops.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.03 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

PART 2 - PRODUCTS

2.01 STAGE-CURTAINS

- A. Description: Complete stage-curtain systems, including stage curtains and tracks; with necessary accessories for support and operation.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Georgia Stage, Inc.
    - b. JB Martin
    - c. KM Fabrics
    - d. Rose Brand.
    - e. S&K Theatrical Draperies, Inc.
    - f. Stagecraft Industries, Inc.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Flame-Propagation Resistance: Passes NFPA 701.
    - a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- b. Permanently attach 12-inch- square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.03 CURTAIN FABRICS

- A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.
- B. Medium-Weight Woven Cotton Velour: Napped fabric of 100 percent cotton weighing not less than 20 oz./linear yd., with pile height not less than 75 mils; 54-inch minimum width.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. JB Martin Company.
    - b. KM Fabrics, Inc.
    - c. Valley Forge Fabrics, Inc.
  - 2. Color/Texture/Pattern: As indicated by manufacturer's designations.

2.04 LINING

- A. Cotton Lining: Yarn-dyed denim cloth of 100 percent cotton; woven in a warp-faced twill; 54-inch minimum width; black.
- B. Ranger Lining: 100 percent cotton fabric weighing not less than 13 oz./linear yd.; 54-inch minimum width; black.
- C. Polyester Lining: 100 percent polyester fabric; inherently and permanently flame resistant; 54-inch minimum width; black.

2.05 CURTAIN FABRICATION

- A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width.
- B. Vertical and Top Hems: Machine sew hems as follows unless otherwise indicated:
  - 1. Vertical Hems: Minimum 2 inches wide, with not less than a 1-inch tuck and with no selvage material visible from front of curtain. Sew open ends of hems closed.
  - 2. Turnbacks: Provide leading- and trailing-edge turnbacks for traveler curtains, formed by folding back not less than 12 inches of face fabric, with not less than a 1-inch tuck, and vertically secured by sewing.
  - 3. Top Hems: Reinforced by double-stitching 3-1/2-inch- wide, heavy, jute or laminated synthetic webbing to top edge on back side of curtain with not less than 2 inches of face fabric turned under.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Fullness:
1. Flat: Provide zero percent fullness in curtains.
  2. 50 Percent Fullness: Provide fullness, exclusive of turnbacks and hems, by tying or hooking together adjacent grommets into round pleats spaced at 12 inches o.c. along top hem reinforcement.
  3. 100 Percent Fullness: Provide fullness, exclusive of turnbacks and hems, by tying or hooking together adjacent grommets 6 inches apart into round pleats spaced at 6 inches o.c. along top hem reinforcement.
- D. Grommets: Brass, No. 3, or No. 4. For black curtains, provide brass or aluminum grommets with black finish.
- E. Bottom Hems: Machine sew hems as follows unless otherwise indicated:
1. For flat curtains without fullness: 4-inch lined hem with pocket for sliding pipe or conduit weight and stiffener into bottom of curtain, and with a concealing flap of same fabric in front of pocket made 2 inches longer than bottom edge of pocket.
  2. For Curtains with Fullness:
    - a. Curtains That Do Not Hang to Floor: Hems not less than 3 inches deep, and with open ends of hems sewn closed.
    - b. Floor-Length Curtains: Hems not less than 6 inches deep, with 1-inch weight tape sewn to top seam of the bottom hem, clear of the finished bottom edge, and with open ends of hems sewn closed.
    - c. Floor-Length Curtains: Hems not less than 6 inches deep, with individual weights in individual closed pockets sewn above finished bottom edge of curtain, and with open ends of hems sewn closed.

2.06 SCRIMS AND DROPS

- A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated. Do not use fabric cuts less than one-half width.
- B. Scrims: Scrim curtain fabric sewn flat. Provide with continuous 6-inch pipe pocket at bottom with 6-inch flap of same fabric in front of pocket. Double-stitch 3-1/2-inch jute or laminated synthetic webbing at top with not less than No. 2 brass grommets spaced at 12 inches o.c. and 1 inch from corner of curtain. Provide not less than 2-inch double-folded side hem and 4-inch bottom hem.
- C. Drops: Muslin fabric, sewn flat, with either horizontal or vertical seams and with selvage to the rear. Provide 6-inch pipe pocket at bottom with 6-inch flap of same fabric in front of pocket. Double-stitch 3-1/2-inch jute or laminated synthetic webbing at top with not less than No. 2 brass grommets spaced at 12 inches o.c. and 1 inch from corner of curtain. Provide not less than 2-inch double-folded side hem and 4-inch bottom hem.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install stage -curtains according to curtain manufacturer's written instructions.

3.02 CURTAIN INSTALLATION

- A. Track Hung: Secure curtains to track carriers with S-hooks.
- B. Batten Hung: Secure curtains to pipe battens with S-hooks.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 11 40 00 – FOODSERVICE EQUIPMENT

**PART 1 – GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This section includes furnishing all labor and material required to provide and deliver all Food Service Equipment herein specified into the building, uncrate, assemble, set-in-place, level and completely install, exclusive of final utility connections.
- B. Furnish all material and labor required to completely provide, deliver and install all Food Service Equipment as specified herein and as shown on the drawings. This work shall be in strict accordance with the plans and specifications with all dimensions verified in the field prior to any fabrication.
  - 1. Coordinate the Food Service Equipment work with the respective trades performing preparatory work for the installation of the Food Service Equipment.
  - 2. Comply with all Federal, State and Municipal regulations which bear on the execution of this project. Food Service aisles shall be a minimum of 36" wide and tray slides shall be mounted at 34" maximum above the finished floor.
- C. WORK INCLUDES:
  - 1. Materials shown on the Food Service Equipment Schedule.
  - 2. Piping, valves, and plumbing accessories that are integral within the equipment.
  - 3. Furnishing control devices such as solenoid valves that are not integral with the equipment, for installation by Mechanical Division 15 and/or Electrical Division 16.
  - 4. Wiring, wiring devices, controls and mechanical accessories that are integral in the equipment.
  - 5. Ventilating ducts, flues, controls and mechanical accessories that are integral in the equipment.
  - 6. Anchors, fasteners, fillers and sealants for mounting equipment securely in place.

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

7. Cooperation with all other contractors on the job including the furnishing of information in the form of drawings, wiring diagrams and other data.
8. Touch-up painting after the installation of the Food Service Equipment.

D. RELATED SECTIONS INCLUDE THE FOLLOWING:

1. Mechanical
2. Electrical

**1.03 QUALITY ASSURANCE**

A. QUALIFICATIONS:

1. Installer: Regularly engaged in providing Food Service Equipment from manufacturers of this type of equipment a minimum of five (5) years with at least five (5) installations of this size and type that are at least each three (3) years old.

B. STANDARD OF MANUFACTURE

1. Food Service Equipment that is specified as "custom" having no manufacture name or model number shall be manufactured by a Food Service Equipment Fabricator with at least five (5) years of experience with engineering, design and fabrication of Food Service Equipment. The manufacture shall be subject to the review of the Architect and/or Consultant and shall be approved by the National Sanitation Foundation. All fabricated equipment shall be constructed in strict compliance with the latest standards of the National Sanitation Foundation and shall bear the mark of the National Sanitation Foundation in full compliance with all applicable codes and ordinances.
2. All electrically heated or operated equipment shall bear the seal of approval of the Under Writers Laboratories and shall comply with the National Electrical Code and all local Codes and Ordinances.
3. All Food Service Equipment that is specified as "buy-out" having a specific manufacture name and model number shall comply with the latest editions of the National Sanitation Foundation.
4. All gas-heated or operated equipment shall bear the seal of approval of the American Gas Association (AGA).
5. All steam heated, or operated equipment shall conform to the standard of the American Society of Mechanical Engineers (ASME) and shall be ASME approved.
6. Food shields and sneeze guards shall meet all the requirements of National Sanitation Foundation (NSF) Standard 2.

**1.04 SUBMITTALS**



MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

A. SHOP DRAWINGS / EQUIPMENT BROCHURES

1. No ordering or fabrication of equipment shall take place until such time as the Equipment Brochures and Shop Drawings have been reviewed in writing by the Architect and/or Consultant. Receipt of this review shall not relieve the Contractor from the responsibility of verifying all quantities and related dimensions, maintaining the specified quality of equipment, and verifying conditions of the job site.
2. Equipment Brochures; within twenty (20) calendar days after award of the contract, submittals in the form of PDF containing Manufacturers specification sheets, dimensioned drawings and/or other pertinent data describing all items of standard manufacture shall be submitted for review by the Architect and/or Consultant. Sheets with the notation "Fabricated Item" and name of the fabricated item, as well as any required mechanical, plumbing or electrical requirements shall be inserted between the Manufacturer's specification sheets describing the "buy-out" equipment; thus, giving a complete Brochure with all times accounted for. These Brochures shall have hard white covers with clear transparent overlays and locking rings. The name of the Contractor, Architect, Consultant and project clearly identified in large readable type. Failure to provide Brochures in the manner as described above will be cause for rejection of said brochures.
3. Rough-in and Equipment Location Drawings; within thirty (30) calendar days after award of the contract, submittals in the form of PDF, complete rough-in and details, electrical and plumbing services with both vertical and horizontal dimensions, from column center-lines or exterior walls for location said connection points and rough-in locations shall be submitted for review by the Architect and/or Consultant. Equipment location plans shall be drawn to scale of not less than 1/4" = 1'-0" and include a schedule of equipment clearly identifying all items. Minimum drawings size shall be 24"x 36".
4. Shop Drawings; within thirty (30) calendar days after award of the contract, submittals in the form of PDF of shop fabrication drawings shall be submitted for review by the Architect and/or Consultant. Plans shall be drawn to scale of not less than 1/2"=1'-0". Additional plan views, elevations and sections at 3/4"=1'-0" shall be supplied of all counters and tables with complete dimensions. All shop practices regarding joints, gussets, bracing, tie-downs, supports, etc. shall be clearly defined as well as gauges and quality of metals and brands and model numbers of all miscellaneous fittings, plumbing and electrical trim. The drawings shall also show locations of blocking (supplied under another sections) for all wall and ceiling mounted Food Service Equipment. Minimum drawings size shall be 24"x36".

B. SAMPLES

1. Provide all samples if specification requested.

C. SUBSTITUTIONS:

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1. Manufacturer's listed in this section are used as standards for quality. All substitutions shall be approved by the Architect and/or Consultant prior to installation.
2. Refer to Division 1 - General Requirements for procedures governing substitutions.
3. Only one substitution for each item will be considered.
4. Installation of any qualified substituted equipment is the Food Service Equipment Contractor's responsibility. Including any mechanical, electrical, structural changes required for the installation of qualified substitution shall be without additional cost to the Owner.

**1.05 DISCREPANCIES**

- A. In the event of discrepancies within the Contract Documents, the Architect and/or Consultant shall be so notified within sufficient time prior to bid opening, ten (10) days to allow issuance of an addendum.
- B. In the event where time does not permit notification or clarification of discrepancies prior to the bid opening, the following shall apply: The drawings and drawing schedules shall govern in matters of quantity; the specifications in matter of quality. In the event of conflict within drawings involving quantities, or within the specifications involving quality, the greater quantity and high quality shall apply. Such discrepancies shall be noted and clarified in the contractors bid. No additional allowances will be made because of errors, ambiguities or omissions that should have been discovered during the preparation of the bid.

**1.06 RESPONSIBILITY**

- A. The work as specified in this division shall include; assuring that all required submittals conform to the intent and meaning of the documents, conditions at the Job Site, and all Local Codes and ordinances.
- B. Visit the Job Site to field check actual wall dimensions and utility rough-ins. Be responsible for furnishing, fabricating, and installing the equipment in accordance with the available space and utility services as they exist on the Job Site.
- C. Check all door openings, passageways, elevators, etc., to verify that the equipment can be transported to its proper location within the building. If necessary, check the possibility with the General Contractor of holding wall erection, placement of doorjambes, window, etc. for the purpose of moving equipment to its proper location.
- D. Notify the Architect and/or Consultant of any discrepancies between the plans and specification prior to fabrication of any equipment, to actual condition on the job.
- E. If any special hoisting equipment and operators are required, include cost as part of the bid for this work.

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

**1.07 DELIVERY AND STORAGE**

- A. All equipment specified herein shall be delivered to the Job Site; received and handled by the Contractor or his authorized agent. The Owner shall in no way be expected to store or handle any such equipment.
- B. All equipment shall be delivered in such a manner as to protect it against dirt, water, chemical or mechanical injury.
- C. Throughout the progress of the work, the Contractor shall keep the working area free of debris of all types resulting from his work.
- D. All packing material shall be removed from the project location by the Contractor.

**1.08 COORDINATION**

- A. Coordinate work with mechanical, electrical, plumbing, interiors and other trades whose work is in conjunction with equipment specified herein.

**1.09 MEASUREMENTS**

- A. Verify all dimensions shown on the drawings by taking field measurements at the Job Site prior to fabrication of equipment or ordering equipment. Proper fit and attachment of all parts is required and is the sole responsibility of the Food Service Contractor. If necessary, all equipment shall be fabricated so that it may be handled through finished door openings.

**1.10 PRODUCT REQUIREMENTS**

- A. Refer to Section 01 64 00 and 01 66 00.

**1.11 GUARANTEE / WARRANTY**

- A. All work shall be guaranteed by the Foodservice Equipment Contractor against all defects for a term of one (1) year from the date of notice of completion. This guarantee shall cover replacement of defective material at the Foodservice Equipment Contractor expense, including transportation and labor. This guarantee will not cover any cost for replacement of parts or work made necessary by carelessness or misuse of the equipment by others.
- B. The Food Service Equipment Contractor shall provide at his own expense the installation, start-up and service for one (1) year from the date of recording the notice of completion of the project; the replacement of all Condensing Units and other Refrigeration Devices supplied under this contract. In addition to this one (1) year free service, the Condensing Units shall have a five (5) year Compressor Warranty; said Warranty commencing at the date of completion.

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Metal for construction purposes, where entirely concealed, shall be steel of wrought iron sections galvanized by the hot-drip process after fabrication. Bolts, screws, rivets, and similar attachments to this galvanized work shall be galvanized or brass. Exposed screw and rivet work shall be finished to match adjacent surfaces, flush and buffed smooth. Finished work shall be free of tool or construction marks, dents, or other imperfections; and at the completion of the work, all metal shall be gone over with a portable machine and buffed and dressed to perfect surfaces.
- B. All materials shall be new and of first grade. All gauges specified herein shall be minimum and shall be established after polishing. They shall refer to:
  - 1. U.S. Standard Gauge for sheets and plates.
  - 2. Stainless steel shall be manufactured by one of the following: Allegheny Ludlum Steel Corporation, American Rolling Mills, U.S. Steel Corporation.
- C. The Contractor will be required to furnish a certified copy of the Mill Analysis of materials to the Architect and/or Consultant.
- D. Stainless steel sheets shall conform to ASTM A240, Type 304 Condition A, 18-8 having a No. 4 finish. No.2B finish shall be acceptable on surfaces of equipment not exposed to view. All sheets shall be uniform throughout in color, finish and appearance.
- E. Stainless steel tubing and pipe shall be Type 304, 18-8, having a No. 4 finish, and shall conform to either ASTM A213 if seamless or ASTM A249 if welded.
- F. Galvanized steel shall be approved grade of copper-bearing steel sheets with a minimum copper content of 20%. All sheets to be commercial quality, stretcher leveled, bonderized and re-rolled to insure smooth surface. Galvanized steel shall not be allowed in the construction and fabrication of any "Fabricated Assembly" items.
- G. All millwork materials shall be free from defect impairing strength, durability, or appearance; straight and free from warpage; and the best grade for their particular function. All wood shall be well seasoned and kiln dried and shall have an average moisture content of 8%, a maximum of 10%, and a minimum of 5%.
- H. Plywood and other woodwork of treatable species, where required by code, shall be fire-retardant treated to result in a flame spread rating of 25 or less with no evidence of significant progressive combustion when tested for 30 minutes duration under ASTM E-84 and shall bear the testing laboratory mark on the surface to be concealed.
- I. Concealed softwood or hardwood lumber shall be of Poplar, Douglas Fir, Basswood, Red Oak, Birch, Maple, Beech or other stable wood and shall be select or better grade,

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

unselected for color and grain, surfaced four sides, square-edged, and straight. Basswood may be used where fire-retardant treated materials are required.

- J. Face veneers shall be matched for color and grain to produce balance and continuity of character. Mineral streaks and other discolorations, wormholes, ruptured grain, loose texture, doze or shake will not be permitted. Face veneer leaves on each surface shall be full-length, book matched, center matched, and sequence matched. Surfaces shall be sequenced, and Blueprint matched. Veneers not otherwise indicated shall be plain sliced. Backing veneers for concealed surfaces shall be of a species and thickness to balance the pull of the face veneers.
- K. Hardwood plywood for painted surfaces shall conform to U.S. Product Standard PS -51-71, Type I, and shall have sound Birch, Maple or other approved close grain hardwood faces suitable for paint finish.
- L. Plastic laminate surfaces shall be laminated with thermosetting decorative sheets in the color, pattern and style as selected by the Architect. Horizontal surfaces shall be laminated with sheets conforming to Federal Specifications L-P-508F, Style D, Type I (general purpose), Grade HP, Class I, 1/16" thick, satin finish with rough sanded backs. Vertical surfaces shall be laminated with sheets conforming to Federal Specification L-P-598F, Style D, Type II (vertical surface), Grade HP, Class I, conforming, satin finish, 1/32" thick or heavier. Balance sheets for backs in concealed locations shall be .020" thick laminate backing sheets conforming to Federal Specification L-P-00508E, Style ND, Type V (backing sheet), Grade HP.
- M. Adhesive for application of plastic laminate to wood surfaces of counter tops shall be Phenolic, Resorcinol or Melamine adhesive conforming to Federal Specification MMM-A-181C and producing a waterproof bond. Adhesive for applying plastic laminate to vertical surfaces shall be either a waterproof type or a water-resistant type such as a Modified Urea Formaldehyde Resin liquid glue conforming to Federal Specification MMM-A-188C. Contact adhesive will not be acceptable.
- N. Plate glass shall be 1/2" thick safety glass with polished edges.
- O. Sealant shall be equal to that manufactured by General Electric. Silicone construction 1200 sealant; in either clear or approved color to match surrounding surfaces.
- P. Sound deadening material shall be equal to that manufactured by H.W. Mortell Co., Kankakee, Illinois, and shall be sprayed by use of a mechanical device to a thickness of not less than 1/8" thick.

## **2.02 FINISHES**

- A. Paint and coatings shall be of an NSF approved type suitable for use in conjunction with Food Service Equipment. Such paint or coating shall be durable, non-toxic, non-dusting, non-flaking and mildew resistant, shall comply with all governing regulations and shall be applied in accordance with the recommendations of the manufacturer.

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. All exterior, galvanized parts, exposed members of framework where specified to be painted shall be cleaned, properly primed with rust inhibiting primer, degreased, and finished with two (2) coats of epoxy-based grey Hammertone paint, unless otherwise specified.
- C. Stainless steel, where exposed, shall be polished to a #4 commercial finish. Where unexposed, finish shall be #2B. The grain of polishing shall run in the same direction wherever possible. Where surfaces are disturbed by the fabricating process, such surfaces shall be refinished to match adjacent undisturbed surfaces.

### **2.03 SHOP FABRICATED EQUIPMENT CONSTRUCTION**

- A. Leg stands for open base tables or dish tables shall be constructed of 1-5/8" dia. 16-gauge stainless steel tubing, with stringer and cross braces of the same material. Joints between legs and cross braces shall be welded and ground smooth. Flattened ends on tube stretchers are not permitted. Mechanical fittings are also not permitted.
  - 1. Stainless Steel Leg Sockets: Component Hardware Group, Inc. model A18-0206, or accepted equal; weld to underside of countertop framing or at bottom of enclosed cabinet unit and fastened with flush set screw locking device.
  - 2. Sanitary Type Stainless Adjustable Foot: Component Hardware Group, Inc. model A10-0851, or accepted equal
- B. Tabletops shall be 14-gauge stainless steel unless otherwise noted, with all shop seams and corners welded, ground smooth and polished. Tops of closed base fixtures shall be reinforced on the underside with a framework of 1-1/2" angles or 16-gauge stainless steel hat section; and on open pipe frames with a 4" channel at each pair of legs. The leg sockets shall be welded to this channel. The channel in turn stud welded to the top. Tops shall be reinforced so that there will be any noticeable deflection. Unless otherwise shown on the detail drawings, metal tops shall be turned down 2", and back at 15-degree angle, with 1-1/8" turn-under, except where adjacent to walls or other pieces of equipment. The wall side shall be turned up 10" and back 2" at a 45-degree angle. Ends of this splash are to be closed. Free corner of tops shall be spherical. All tops shall have 1/8" of sound-deadening material applied to the underside by use of spray equipment in an oven, smooth application for ease in cleaning.
- C. Enclosed bases or cabinet bodies shall be of the material and gauge hereinafter specified. They shall be enclosed on the ends and sides as required. The bases shall be reinforced at the top with a framework of 1-1/2" x 1-1/2" x 1/8" stainless steel angles fully welded to the base with the stainless-steel angles 36" on center (maximum), with all corners of said framework mitered and fully welded. All vertical joints of the bases shall be fully welded, ground and polished. All free corners of enclosed bases or cabinet bodies and all corners against walls and other fixtures shall be square. In the case of fixtures fitting against or between walls, the bodies shall be set in 1" from the wall line, but the tops shall be extended back to the wall line to permit adjustment to wall irregularities. A flush fitting vertical trim strip (extension of the vertical end mullion without vertical seam of the same material as the body shall be provided at each end of the body

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

and shall extend 1" to the wall line). These fixtures shall be constructed to set on bases or legs as hereinafter specified and shall be set in mastic in a vermin-proof manner.

- D. Shelves, mullions and aprons shall be fabricated flush with the cabinet body, welded, ground, and polished. Butt joints are not acceptable.
- E. Drawers, to be furnished with stainless steel flush pull, Component Hardware Group Inc., model number P63-1012 or equal installed into the 18-gauge double-pan drawer front panel.
  - 1. Stainless steel locks, Component Hardware Group, Inc., model number P30-4781 or equal for each drawer. All drawers are to be keyed alike.
  - 2. Stainless Steel full extension slides, Component Hardware Group, Inc., model no S52-0024 or equal. Provide two (2) per drawer. Slides to be installed so drawer will roll closed when released.
  - 3. Stainless steel removable drawer pan, Component Hardware Group, Inc., model number, S81-1520 or equal one (1) per drawer set loosely in a channel frame so it can be easily lifted out for cleaning. This supporting frame shall be welded stainless steel channel.
  - 4. Drawer face panel to be constructed of 18-gauge stainless steel double pan construction. (Single metal thickness drawer faces are not be expectable.)
- F. Hinged doors in base cabinets shall be of double pan construction, insulated and constructed of 18-gauge stainless steel. Doors shall have wire type pull Component Hardware Group Inc., model number P46-1010 or equal installed as shown in elevations. Door pulls to be NSF and ADA compliant.
- G. Interior shelves shall be solid, non-removable 16-gauge stainless steel, with ends and backs provided with a 1-1/2" high turn-up against the body of the fixture and welded to the same. Front edge is to be turned down 1-1/2" and under 1/2", at the bottom shelf, beyond the edge of the base to prevent sagging and vermin collection.
- H. Under shelves on open tables shall be constructed of 16-gauge stainless steel, flanged down 90 degrees 1/2". The corners shall be welded to the legs. Under shelves shall be 10" from the floor. Backs shall be turned up 2".
- I. Elevated shelves shall be constructed of 16-gauge stainless steel with edges turned down in a square edge, and back 1/8"; except where shelves are adjacent to walls or other fixtures, where they shall be turned up 2". Corners shall be spherical, mounted on 14-gauge stainless steel support brackets.
- J. Sinks and drain boards shall be constructed of 14-gauge stainless steel. The working edge of the sink shall be provided with 5/8" radius sanitary rolled edge in one piece with rounded corners. The drain boards shall be made as an integral part of the sink; all vertical and horizontal corners shall be rounded with 5/8" radius; and the working front edges shall be maintained at one level, taking up the pitch of the drain boards by

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

dropping the sink to allow for same. Depth of sink bowl shall be determined from the top bowl. Sinks shall be provided with back and end splashes with top edge flanged back 2-1/4" at 45-degree angle and attached to the building wall with "zee" clips. Splash back of sinks and drain boards shall be grained in the same direction. Suitable openings shall be cut for hot and cold-water supplies and waste outlets. All surface plumbing trim as called for on the drawings and herein specified shall be provided. Bottom of each sink bowl with center drain connection shall be fitted with a 2" lever type action waste valve mounted into the sink and made absolutely watertight. Sink bowls and drain boards shall have 1/8" of sound-deadening material underneath, spray-applied.

- K. Rivets, bolts and screws shall not be permitted in any exposed location.
- L. All welding shall be of the heliarc method with welding rod of the same composition as the parts welded. Welds shall be complete, strong, and ductile with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections and shall be continuously welded so that the fixture shall appear as one-piece construction. Butt welds made by spot solder and finished by grinding are not acceptable.
- M. All exposed joints shall be ground flush with adjoining material and finished to harmonize therein. Whenever material has been sunk or depressed by welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surface and, if necessary, again ground to eliminate low spots. In all cases, the grain of rough grinding shall be removed by successive fine polishing operations.
- N. All exposed welded joints in stainless steel construction shall be suitably coated with an approved metallic-based paint.
- O. After galvanized steel members have been welded, all welds and areas where galvanizing has been damaged shall have a zinc dust coating applied.
- P. Seams shall be continuous welds flush and ground smooth.
  - 1. Field Joints: Flush welded, ground smooth and polished on the job, solder or rivets not allowed.
  - 2. Counter Tops: Field joints in stainless steel counter tops and drain boards butt welded with welds ground flush and smooth and polished to match original finish.
  - 3. Pass windows: Provide a complete all welded seamless counter from inside area to the outside ledge at each pass window location. Mechanical joints, butt joints or lap joints will not be accepted.

## **2.04 ELECTRICAL REQUIREMENTS**

- A. Standard UL listed materials, devices and components shall be selected and installed in accordance with NEMA Standards and Recommendations and as required for safe and



MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

efficient use and operation of the Food Service Equipment without objectionable noise, vibration, and sanitation problems.

- B. Motors up to and including ½ HP are to be wired for 120-volt, single phase. Fixtures totaling more than 1000 watts are to be wired for 208-volt, single-phase. Fixtures having multiple number of heating elements, can be wired for three-phase with the load balanced as equally as possible within the fixture.
- C. Heating elements having a connected load of up to and including 1000 watts are to be wired for 120-volt, single-phase. Fixtures totaling more than 1000 watts are to be wired for 208-volt, single-phase. Fixtures having multiple number of heating elements can be wired for three-phase with the load balanced as equally as possible within the fixture.
- D. Equipment where applicable shall be furnished with three-wire cord and plug.

## **2.05 PLUMBING TRIM, SINKS**

- A. All vegetable and pot washing sinks, or other 14" deep sinks shall have Fisher Mfg. Co. Model 22209 series (2" drain size) quick opening drain. Fisher Mfg. Co. Model 60100 splash mounted faucet shall be mounted over each partition as shown on the drawings.
- B. All cook sinks, pantry sinks or other 10" or 12" deep sinks shall have Fisher Mfg. Co. Model 22209 series (2" drain size or as shown on the drawings) quick opening drain. Fisher Mfg. Co. Model 57649 faucets mounted as shown on the drawings.
- C. All Fisher Mfg., Co. faucets to be furnished as stainless steel to comply with AD1953 Standards and conform to NSF 61 Standard 9.
- D. Provide gas pressure regulators for installation by the Plumbing Contractor.
- E. FIRE SUPPRESSION GAS SHUT/OFF VALVE: Gas valve to be furnished by the Foodservice Equipment Contractor and furnished to the Plumbing Contractor for installation. Foodservice Equipment Contractor is to verify with Plumbing Division for gas line size. Valve to be located in an accessible location and if necessary, with access panel.

## **2.06 HARDWARE**

- A. Elevated shelf brackets shall be as shown on the Drawings.
- B. Drawer and door handles shall be as shown on the Drawings.
- C. Hinges for all metal doors shall be Klein Hardware Co. 7870 series, finished in satin chrome.

## **2.07 REFRIGERATION**

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

A. Each refrigeration items specification is written to provide minimum specifications and scope of work. Refrigeration equipment shall be designed and installed to maintain the following general temperature unless otherwise specified.

|    |                            |                 |
|----|----------------------------|-----------------|
| a. | Walk-In Refrigerators      | 1.7°C / 35°F    |
| b. | Walk-In Freezers           | -23.2°C / -10°F |
| c. | Reach-In Refrigerators     | 1.7°C / 35°F    |
| d. | Reach-In Freezers          | -23.2°C / -10°F |
| e. | Undercounter Refrigerators | 1.7°C / 35°F    |
| f. | Undercounter Freezers      | -23.2°C / -10°F |
| g. | Cold Pan                   | 5°C / 41°F      |

### **PART 3 - INSTALLATION**

#### **3.01 POSITIONING OF EQUIPMENT**

- A. Installation procedure, details and scheduling shall be so arranged that the work of other contractors may progress without unnecessary delay, interference or damage.
- B. The Contractor shall do all fitting, joining, fastening, scribing, caulking and adjusting necessary to install any fixed item of equipment in its designated location; and shall locate and/or store portable, non-fixed items as directed by the Architect and/or Consultant with due regard for the security and protection from damage of the items involved.

#### **3.02 WORKMANSHIP**

- A. Commencement of work shall constitute agreement with and acceptance of all conditions as found.
- B. Equipment shall be installed as shown on the plans. Where abutting, curved or irregularly shaped angles or projecting corners of walls occur, equipment shall be made to conform. Where several pieces of equipment are to be assembled in a group, the group shall be complete as whole, with all necessary filler or connecting pieces as may be required to make a complete, sanitary and vermin-proof group.
- C. Welded parts shall be non-porous and free of imperfections. Welds on galvanized metal shall be ground smooth, sandblasted and sprayed with molten zinc or 1200 degrees F to a thickness of .004". Tinning of welds will not be acceptable. Welds of stainless steel shall be ground and polished to the original finish and all grained in the same direction.
- D. All fixtures, unless made of stainless steel, shall be finished in sprayed lacquer in color as chosen by the architect; or if specifically stated, in "plastic laminate"; in pattern and/or color as selected by the Architect.

#### **3.03 POST INSTALLATION PROCEDURES**

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- A. Prior to being offered for final acceptance, all equipment shall be thoroughly cleaned. This shall include removal of all stains, paint spots, protective wrapping and coatings, tapes, grease, oil, plaster, dust, polishing compounds, etc. and cleaning of floors in food service areas (broom clean) and signed off by the General Contractor with a copy to the Architect and/or Consultant.
- B. After installation at least ten (10) days prior to offering for acceptance, all equipment shall undergo a "Start-up" procedure by a Factory Authorized Service Dealer. Equipment is to be inspected, tested, calibrated and adjusted for normal operation conditions. If inspection or testing indicated defects, such defects shall be corrected, and the inspection and test repeated to insure a perfect operation of all equipment, prior to final acceptance and for a period ninety (90) days after final acceptance.
- C. Upon completion of the project, the Contractor shall furnish the Owner two (2) sets of Dimensional Prints, Data Sheets, Spare Parts Lists and Operating Manuals for each piece of mechanical equipment; each set shall be neatly bound in a loose-leaf binder, each set shall be complete with and Index of Equipment and with a complete List of Service Contracts with said agencies to perform these services. In addition to this list: The Contractor shall submit for review of the Architect and/or Contractor and submittal to the Owner for his files, copies of Service Contracts with said agencies to perform these services. It shall be the responsibility of this Contractor to fill out and forward all warranty forms as required.
- D. This contractor shall arrange demonstrations of the operation and maintenance of all "Buy-Out" equipment by competent instructors. These demonstrations to take place within ten (10) days prior to the acceptance of the kitchen. All instruction periods shall be scheduled with the Architect and/or Consultant fourteen (14) days prior to commencement of same, and at times convenient to the Architect and/or consultant and Owner.

#### **PART 4 - ITEMIZED EQUIPMENT SCHEDULE**

##### **4.01 FOOD SERVICE EQUIPMENT LIST AND DESCRIPTION**

- A. Fabricated Equipment: Wherever the term "Fabricated Assembly" is used within the list noted below and description of Food Service Equipment, it shall be presumed to be followed by the phrase, "constructed to the configuration, dimension, detail and design as shown on the drawings and specifications and with workmanship and materials as specified above" and shall meet the Fabrication Detail Requirements of the latest edition of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), and National Sanitation Foundation (NSF Standard 2).
- B. All Food Service Equipment shall be installed per the "Guidelines for Seismic Restraints of Kitchen Equipment" by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. All Food Service Equipment shall comply with the standards of The California Code of Regulations, Title 24, Part No. 2.
- D. All Food Service Equipment shall comply with the current California Energy Commission Appliance Efficiency Regulations.
- E. Equipment in the following schedule is listed by Item Numbers shown on Drawings.
- F. Equipment listed is schedule as (OFCI) means Owner Furnished Contractor Installed.

1. SCHEDULED ITEMS

**ITEM #1 AIR CURTAIN**

Quantity: One (1)

Manufacturer: Berner (or equal)

Model: SLC07-1072A

Status: CFCI

Sanitation Series Low Profile Air Curtain, 72"L, unheated, (1) 1/5 hp motor, for doors up to 7' high, specify exterior, interior or exterior mounting, UL, cULus, UL EPH, MADE IN USA

Accessories:

- 1 ea. Five year parts warranty (unheated units)
- 1 ea. Model A 120v/60/1-ph
- 1 ea. White powder coat exterior finish, standard
- 1 ea. Model 9503SD020-P Automatic Door Switch, plunger type, activates air door when door opens, single phase only & max. amp draw of 20 amps, 120-240V
- 1 ea. Multiple manual door openings require an additional plunger door switch
- 1 ea. Model 66ZPR000WMB-AZ-007-WP Z Wall Bracket, adjustable depth, white powder coated finish, priced per each (one pair)
- 1 ea. Model 66ADS000DMB Mounting Bracket, for plunger door switch used with manual swing doors (field mounted)

**ITEM #2 SHELVING, WALL MOUNTED**

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: SWS1548-14/3

Status: CFCI

Shelf, wall-mounted, 48"W x 15"D, rolled front edge, 1-1/2"H up-turn on sides & rear, stainless steel wall brackets mount to wall studs (no wall backing required), 180 lbs. weight capacity, 14/304 stainless steel construction, NSF

**ITEM #3 CABINET, MOBILE, WARMING AND HOLDING**

Quantity: TWO (2)

Manufacturer: CRES CORE

Model:

Status: OFCI

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

This item is owner furnished contractor installed. Contractor is to verify and provide utility requirements with existing equipment.

**ITEM #4 EXHAUST HOOD, TYPE 1, LOW PROFILE**

Quantity: One (1)

Manufacturer: Streivor

Model: WCLC 90 63 22.5

Status: CFCI

CKV Hood UL Listed 710      Hood Exhaust : 1575   CFM   @ 0.63  
(WC)SP

Commercial Kitchen Ventilation Specification

See plans for location and placement of item with reference to adjoining equipment. Furnish and install per Manufacturer's standard specifications and the following:

- \* Install in the location as shown on drawings. It is the responsibility of the Installer to verify all clearances and stand offs from the hood to limited combustibles and/or combustible materials. Hood must be installed in accordance with the Manufacturer's specifications. Canopy Hoods to be installed a minimum of 78 inches above the finished floor and level. ADA requires 80 inches minimum above the finished floor.
- \* The Hood assembly to be size and shape per the drawings. Hood to be U.L. listed #710, NSF listed and built in compliance with the prevailing NFPA Standard #96. The hood ends shall be fabricated from 16 gauge stainless steel or heavier and have a Performedge shape at the lower most part of the end. The remainder of the hood will be fabricated of material not less than 18 gauge. All exposed surfaces to be fabricated from Type 304 stainless steel with a #4 finish. All exposed welds to be ground smooth and polished to a #4 finish. Exhaust airflow volume and static pressure at the duct collar(s) shall not exceed those shown on the drawings.
- \* Stainless steel matching enclosure panels from the top of the Hood to the finished ceiling to be furnished by KEC. (Verify ceiling height with plan.)
- \* All electrical connections, materials and labor to connect high and low voltage electrical to the hood lights, temperature monitors, electrical components and/or the Fire Suppression System including micro-switch(es) by other. See fire suppression system for additional detail.
- \* Hood Manufacturer to provide engineering and shop drawings for approval prior to fabrication.
- \* Exhaust and Supply Fans to be furnished by Mechanical Division in compliance with local and National Codes. See Hood Manufacturer's specification sheets for CFM and static pressure requirements.
- \* Duct connections by Mechanical. An air balance test should be performed before cooking start up to insure correct exhaust and supply airflow rates.
- \* Hood must be manufactured UL 710 Listed, NFPA 96 compliant and installed in accordance with all prevailing codes and standards.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

### 3" Stand Off

Back The hood assembly to be per the size and shape shown on the drawing. A 3" stand off (enclosed on all sides) to be included on the entire back outer perimeter of the hood. Stand off to be fabricated from 18 gauge stainless steel of the same material and with the same finish as the hood. All exposed corners with welded and polished to a #4 finish.

### Extractor

FLSS Hood to be fitted with stainless steel baffle filters. Filters to be UL1046 Listed, NSF approved. The filters will be easily removable for cleaning.

### Exposed Canopy Material

304 Stainless Steel Type 304 Stainless Steel (SS) is in the "Austenitic group of SS" comprising approximately 18% chromium and 8% nickel. Type 304's resistance to corrosive acids makes it ideal for hoods, sinks and tabletops. Type 304 SS is comprised of no more than 0.8% carbon and at least 50% iron. The chromium binds oxygen to the surface of the product to protect the iron from oxidation (rust).

Nickel also enhances the corrosion resistance of stainless steel. Therefore, the higher the nickel content, the more resistant the stainless steel is to corrosion. Type 304 SS is non-magnetic.

### Non-Exposed Exhaust Plenum Material

304 Stainless Steel Type 304 Stainless Steel (SS) is in the "Austenitic group of SS" comprising approximately 18% chromium and 8% nickel. Type 304's resistance to corrosive acids makes it ideal for hoods, sinks and tabletops. Type 304 SS is comprised of no more than 0.8% carbon and at least 50% iron. The chromium binds oxygen to the surface of the product to protect the iron from oxidation (rust).

Nickel also enhances the corrosion resistance of stainless steel. Therefore, the higher the nickel content, the more resistant the stainless steel is to corrosion. Type 304 SS is non-magnetic.

### Light Fixture

### Surface Mounted Warm LED

Hood to be fitted with UL & NSF Listed Surface Mounted Commercial Kitchen Hood light fixtures. Light fixture to have brushed aluminum housing, tempered glass, shatter resistant globe. Light fixture(s) to be prewired to a single connection point for each hood. To be fitted with LED lamp.

### Lamps

### Surface Mounted Warm LED

LED lamp, 120vac, UL Listed for exhaust canopy hoods, 12 Watt, 960 Lumens, 4500K to 5500K, maximum operating temperature 80 degrees C (176°F). 120 degree Beam angle, rated for 50,000 hour lamp life, mercury-free, instant (no ballast), exceeds Federal Energy Act requirement, no ultraviolet light emission. Fits any A19/E26/E27 fixture (globe must be installed to comply with UL listing).

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

#### Auto Fan Start

An Auto Fan Start is required for NFPA 96 Section 8.2.3.3. Auto Fan Switches may be located in each hood exhaust collar or the hood canopy. Auto Fan Switches in the canopy have a maximum spacing of 84".

#### Access Enclosure Hood Exhaust Collar Mounted

Hood Exhaust Collar to be fitted with UL 710 listed Access Enclosure(s) size and shape per the drawing with a removable cover plate that protects and allows access to monitoring equipment from inside of the hood exhaust plenum. The removable cover to be held in place by stainless steel fasteners. When the Enclosure's cover is removed it allows easy access for installation, adjustments and service to the equipment inside the hood exhaust collar. Access Enclosures to be fabricated from 18 gauge stainless steel of the same material and with the same finish as the hood. All welds to be ground smooth and polished to a #4 finish.

#### Ceiling Enclosure

Stainless steel matching enclosure panels from the top of the Hood to the finished ceiling. (Verify ceiling height with plan.) Ceiling Enclosure panels to be fabricated of 18 gauge stainless steel (material type and finish to be the same as the hood). Any exposed welds to be ground smooth and polished to a #4 finish.

#### Double Wall Construction

Double Wall Panel(s) to be fabricated from 18 gauge stainless steel of the same material and with the same finish as the hood. Panel(s) contain a UL listed fiber insulation that is 1" thick. Panel dimensions and locations to be per size and shape shown on the drawing. Double Wall Panels to be welded to the hood by hood manufacturer.

Model: DemandAire Bronze Non-Variable Speed Control System

Project: Matsuyama ES - Sacramento  
Item# 42

Hoods Controlled : #4

#### UL Listed SOSA

- \* See plans for location and placement of item with reference to adjoining equipment. See schematics for utility connection and operation. Furnish and install per Manufacturer's standard specifications and the following:
- \* Install in the location as shown on drawings. It is the responsibility of the Installer to verify all clearances.
- \* Non-Variable Speed Control Systems are to be UL 508A listed and include automatic controls necessary to respond to cooking appliance operation as necessary to maintain

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- full capture and containment of smoke, effluent and combustion products during cooking and idle.
- \* Systems shall include failsafe controls that result in full fan flow upon a cooking sensor failure.
  - \* Systems shall include Ambient Temperature Monitoring (ATM) to monitor the temperature of the air in the kitchen space surrounding the hood system.
  - \* Systems shall include Duct Temperature Monitoring controls that monitor the totality of cooking appliances below each hood. Temperature monitors are to be installed in the hood exhaust collar(s) to measure the hood exhaust air temperature.
  - \* Systems shall include UL 710 Listed access enclosure(s) that allow access to the temperature monitors from below the hood for installation and commissioning. Systems that include temperature monitors or other electrical components which are not accessible from below the hood(s) via UL 710 listed access enclosure(s) are not acceptable.
  - \* Systems shall compare hood temperatures to the ambient temperature of the kitchen space to determine the state of cooking appliances. Power supplied to the exhaust and/or supply fan(s) shall be provided based on cooking appliance demand using differential controls and an algorithm to optimize energy savings.
  - \* Systems shall include fan and lighting controls, diagnostic tools, system settings, and alarm notifications to be provided by means of a Human Machine Interface (HMI) with monochrome touch screen. The HMI is door mounted to a Type I UL Listed stainless steel enclosure which may be recessed into a wall, surfaced mounted on a wall, or flush mounted on the front of a hood utility cabinet.
  - \* Systems shall include a Programmable Logic Controller {PLC}, 24 VDC power supply, relays, terminal blocks, color-coded wiring, housed in Type I UL Listed stainless steel enclosures which may be hood mounted in a utility cabinet or be wall mounted, surface or recessed.
  - \* The HMI shall include manual controls including a 100% exhaust power switch and hood on/off light switch. The HMI shall include diagnostic tools and display screen for hood and ambient temperature status, fan motor status and control history, and audible/visual alarm notification.
  - \* The HMI shall include password protected settings for temperature monitor set points, fan off-delay time, alarm triggers and fire suppression system settings.
  - \* Systems shall provide start/stop control signals to Motor Starters or BMS (not provided by the manufacturer unless specifically included herein) to control the exhaust and supply fans at non-variable speed based on cooking conditions below each hood based on inputs from hood and ambient temperature monitors, manual controls from the HMI, and fire suppression system actuation.
  - \* Systems Do Not Include Motor Starters consisting of Contactors and Overloads.
  - \* Hood and ambient temperature monitors shall be stainless steel Platinum 100 3-Wire Resistance Temperature Detectors (RTD).
  - \* Systems shall be engineered with connections for shunting electrical equipment below the hood, shunting electric gas valves, shunting SmartAire Internal Hood Fans (IHF),



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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- shunting makeup air, operating exhaust fans at full capacity and signaling building alarm system during a fire suppression system actuation.
- \* Systems shall have an integrated electric gas valve reset relay that is accessed via the HMI and requires manual reset of the power to the electric gas valve(s) after the fire suppression system has been rearmed following a fire suppression system actuation or loss of power.
  - \* Systems shall be capable of providing real time system status such as hood and ambient temperature data, system faults, fan power operating status and other information via Modbus TCP communication.
  - \* Manufacturer will provide control schematics, installation and operation manuals, and sequence of operation documents.
  - \* Manufacturer will provide pre-installation phone consultation to answer questions regarding the system.
  - \* Manufacturer may provide on-site commissioning support during startup of the hood system(s). See contract for on-site duration allocated for commissioning if applicable.
  - \* (Manufacturer will not provide) control panel supply power (120VAC, 20 amps), electric gas valve supply power (120VAC, 20 amps), high voltage motor supply power, Motor Starter(s), or field wiring between control panel and RTD temperature monitors, fire suppression system microswitches, HMI, shunt trip breakers, BMS, exhaust and supply fan Motor Starters, exhaust and supply fan motors, electrical gas valve(s), and hood lights, unless specifically noted herein or any other unspecified materials or labor.
  - \* The above exclusions, including labor and materials, to be provided by qualified contractor at no expense to Manufacturer.

**ITEM #4.1 FIRE SUPPRESSION SYSTEM**

Quantity: One (1)

Manufacturer: STREIVOR (OR EQUAL)

Model: Ansul R102

Status: CFCI

Project Name - Matsuyama ES - Sacramento - 4.1 Ansul R102 Fire Suppression System - Turn Key Fire System

Hood# ( 4 )Ansul R102 UL 300 Listed Restaurant Fire Suppression System. Includes Fire System Drawing, Control Actuator, Cylinder(s) and Chemical Suppressant, Chemical and Detection lines pre-piped at the factory, 1ea manual pull station, appliance, duct and plenum nozzles. Installation, Start Up and System Test to be performed by a certified professional of Streivor's choosing.

NOT INCLUDED - Connection to Pollution Control Unit(s), Project Labor Agreements (PLA), NICET Certification.

NOT INCLUDED - Fire Suppression Pre-Test. If required, a site visit for each Fire Suppression Pre-Test must also be purchased.

NOT INCLUDED - Fire Permit, Additional Signage, Electric Gas Shutoff Valve, Reset Relay, Union installation rates, OCIP, Simultaneous activation of multiple systems, Y-Strainer.

FSS Drawing & Engineering - Included Fire Suppression System engineering, drawings, and applicable permits.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

Utility Cabinet - Included Wall Mounted Utility Cabinet 18 Gauge Type 304 stainless steel with a #4 polish includes heavy duty angle iron frame and removable door panel and recessed pull. See drawings for size and shape.

Prevailing Wage Install - Included (PLA Not Included) Includes prevailing wages for installation of Fire Suppression System.

K Class Fire Extinguisher - Ansul R102 Class K "Kitchen Use" wall mounted 6 Liter wet chemical Fire Extinguisher.

NOT INCLUDED - Streivor is not responsible for any Fire Suppression System electrical wiring or final wiring connections. Streivor is not responsible for any gas shut-off valve or water plumbing required for a fire suppression system. Y Strainer installation required by gas shut-off valve manufacturer to protect fire system gas shut-off valve.

**ITEM #5 COMBI OVEN, ELECTRIC**

Quantity: One (1)

Manufacturer: RATIONAL (or equal)

Model: ICP 6-FULL ON 6-FULL E 480V 3 PH

Status: CFCI

Two (2) (CC1ERRA.0000219) iCombi Pro® 6-Full Size Combi Ovens, double stack, electric, (12) 18" x 26" sheet pan or (24) 12" x 20" steam pan or (12) 2/1 GN pan capacity, (6) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 440/480v/60/3-ph, 22.4 kW each, CE, IPX5, UL, cULus, NSF, ENERGY STAR®

Accessories:

- 1 ea. Model 60.74.725 Combi-Duo Stacking Kit for iCombi 6-full size (electric or gas) on iCombi 6- or 10-full size (electric only)
- 1 ea. 2 years parts and labor, 5 years steam generator warranty
- 1 ea. Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 ea. Model 1900.1150US Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CL filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
- 1 ea. NOTE: The RATIONAL Water Filtration Systems helps provide consistent high quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates
- 1 ea. Free Water Testing Kits are available (contact factory for info)
- 1 ea. Model 60.31.205 Stand I Stationary Oven Stand for Combi-Duo (MarineLine), 7-3/4"H, open sides, with fixing mount, for iCombi 6-full size on 6-full size
- 1 ea. Model 60.76.316 Sous-Vide Core Temperature Probe, USB connection, for 6, 10, and 20 Full and Half size models

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 1 ea. Model 60.76.317 External Core Temperature Probe, USB connection, for 6 and 10 Half and Full size models
- 1 ea. Model 60.75.768 Heat Shield, for right side panel, type 6-full size Pro/Classic

**ITEM #6 INDUCTION RANGE, COUNTERTOP W/ STAND**

Quantity: One (1)

Manufacturer: CookTek (or equal)

Model: 620701

Status: CFCI

Induction Range, countertop, double hob (front to back), glass-ceramic top, sloped front, independent controls, built-in cooking timer, microprocessor with (100) power cook settings & auto shut-off, self-diagnostics, automatic pan detection, LCD display, integral cooling fan & grease filter, stainless steel exterior, 200-240v/50/60/1-ph, 7000 watts, 30.0 amps, 6 ft. cord, cETLus, NSF, CE, Made in USA

Accessories:

- 1 ea. Two year limited parts and labor warranty in US/Canada only and 7 year enrollment in the CookTek Advanced Replacement Program (ARP)
- 1 ea. Destination - US United States or Canada, NEMA 6-50P

Fabricated assembly in length and configuration as shown on the drawings and shall include the following:

- A. Work area top to be 14-gauge stainless steel with a 14-gauge stainless steel backsplash 2" thick with a 45-degree to top with enclosed back splash. Top to be constructed with 2" turn down on front and sides.
- B. Provide 1 5/8" dia. S/S tube legs with Component Hardware Group, Inc. A10-0851 adjustable foot insert.
- C. Contractor to provide seismic flanged feet.

**ITEM #7 PREP SINK, TWO (2) COMPARTMENTS**

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: FN2036-2-24-14/3

Status: CFCI

Sink, two compartment, 88"W x 27"D, 14/304 stainless steel top, coved corners, 18" wide x 20" front-to-back x 14" deep compartments, 24" drainboards on left & right, 9-1/2"H backsplash with 1" turn down, 8" OC splash mount faucet holes, rolled edges on front, enclosed splash on left and right side, includes 3-1/2" basket drains, stainless steel cross bracing on all sides, stainless steel legs & adjustable bullet feet, NSF

Accessories:

- 1 ea. Model 300804 Faucet, 14" long, splash-mounted mixing faucet, 8" centers, swing nozzle, NSF
- 2 ea. Model 341189 Twist Handle Drain, 1-1/2 or 2" NPS connection
- 2 ea. Model -TB Twist bracket, per drain

**ITEM #8 HAND SINK**

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

Model: HSAP-14-ADA-FW

Status: CFCI

Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

Accessories:

- 1 ea. Model 313305 T&S Extra Heavy Duty Gooseneck Faucet, wrist handles, splash mount 4" OC, NSF
- 1 ea. Model -LRS Left & right side splashes

**ITEM #9 CLEAN DISHTABLE**

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: CDTR-60-14/3

Status: CFCI

Clean Dishtable, straight design, 60"W x 30"D x 43-1/2"H overall, left-to-right operation, 14/304 stainless steel top, 8"H backsplash, raised rolled edges on front, enclosed splash on right-side, stainless-steel legs & crossbracing, adjustable seismic flanged feet, NSF

Accessories:

- 1 ea. Model E101A Turn down back of splash per table with Z clip

**ITEM #10 DISHWASHER, DOOR TYPE, VENTLESS**

Quantity: One (1)

Manufacturer: Hobart

Model: AM16VLT-ADV-2

Status: CFCI

Ventless Dishwashing Machine, tall chamber (27") door type, energy recovery, automatic soil removal (ASR), drain water energy recovery (DWER), high temp sanitizing, 208-240/60/3 (field convertible to single phase), internal condensing system, 38 racks/hour, straight-thru or corner installation, user-friendly smart touchscreen controls, Wi-Fi connectivity with SmartConnect app, Sense-A-Temp™ booster, electric tank heat, X-shaped wash arms, scrap screen and basket, door actuated start, door lock, stainless steel tank, tank shelf, chamber, trim panels, frame & feet, pumped drain air gap, drain water tempering, cULus, NSF, ENERGY STAR®. Factory Startup - Free for installations within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; installation beyond 100 miles will be quoted by Service.

Accessories:

- 1 ea. Oversized units with crated shipping dimensions greater or equal to 72" in length and/or 90" in height. If delivery is to a facility without a standard height dock, additional shipping charges will apply depending on the service requested. consult Factory.
- 1 ea. Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA
- 1 ea. Model RAPID-FILL1-AM16 Rapid Fill Kit Single Valve – For faster filling, requires separate hot water connection
- 1 ea. Model ACC-INSTALL-RAPID16 Accessory Installation - for installation within 100 miles of a Hobart Service Office during normal business hours with appropriate notice; installation beyond 100 miles will be quoted by Service. Includes installation of this item only, final electrical or plumbing connections by others. Recommendation: coordinate accessory installation with machine assembly/ installation (NET)
- 1 ea. Model WTRHAMARREST-AM16 Water Hammer Arrestor – Assembly includes 3/4" brass pressure regulator, pressure gauge, shock arrestor and garden hose adapter

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- 1 ea. Model FLNG-FT-AM16 Flanged Feet, Bolt Down – Set of 4
- 1 ea. Model SCREEN-GUARD-AM16 Touch Screen Guard – cover to protect screen
- 1 ea. Model WS80-NOINSTALL Water softening system 4,818 grains/lb capacity, 14 gallons regeneration volume, salt alarm, holds 2 bags of salt, pricing DOES NOT include installation. INSTALLATION BY AUTHORIZED HOBART SERVICE OFFICE IS RECOMMENDED (NET)

**ITEM #11 SOILED DISHTABLE**

Quantity: One (1)

Manufacturer: Eagle Group (or equal)

Model: SDTL-60-14/3

Status: CFCI

Soiled Dishtable, straight design, 60"W x 30"D x 43-1/2"H overall, left-to-right operation, 14/304 stainless steel top, 8"H backsplash at back and left side, 20" x 20" x 5" deep pre-rinse sink with basket drain, (1) deck mount faucet hole for pre-rinse, includes scrap block, raised rolled edges on front, stainless steel legs & side bracing, adjustable seismic flanged feet, NSF

- 1 ea. Model E101A Turn down back of splash per table with Z clip
- 1 ea. Model E30 End splash, factory installed, welded, per end, all heights (specify end)
- 1 ea. Model -SRP Dishtable Kit, includes scrap basket, rack slide & T & S pre-rinse
- 1 ea. Model 383671 Pre-rinse Basket, 19-1/2"W x 19-1/2"L x 4"H, with slide bar, for dishtables, 304 type stainless steel
- 1 ea. No scrap block, add suffix "-NSB" to model number, Deduct
- 1 ea. Model 301190 Pre-Rinse Wall Bracket
- 1 ea. Model 313295 T&S Pre-Rinse Spray, deck mount with mixing valve, wall bracket, extra heavy-duty
- 1 ea. Model 305428 Sink Cover, fits 20" x 20" sink bowl, stainless steel
- 1 ea. Model 300720 Lever Handle Drain, 1-1/2" or 2" IPS connection

**ITEM #12 THREE (3) COMPARTMENT SINK**

Quantity: One (1)

Manufacturer: Eagle Group

Model: FN2860-3-24-14/3

Status: CFCI

Sink, three compartment, 114"W x 35"D, 14/304 stainless steel top, coved corners, 20" wide x 28" front-to-back x 14" deep compartments, 24" drainboards on left & right, 9-1/2"H backsplash with 1" turn down to z clip, (2) sets of 8" OC splash mount faucet holes, rolled edges on front & sides, includes 3-1/2" basket drains, stainless steel crossbracing on all sides, stainless steel legs & adjustable flanged feet, NSF

**ITEM #14 MOP HOLDER**

Quantity: One (1)

Manufacturer: Advance Tabco (or equal)

Model: K-242

Status: CFCI

Mop Hanger, 23", accommodates (3)

**ITEM #15 MOP DRIP TRAY**

Quantity: One (1)

Manufacturer: Advance Tabco (or equal)

MATSUYAMA ELEMENTARY SCHOOL  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

Model: K-243  
Status: CFCI  
Mop Drainage Tray, stainless steel

**ITEM #16 WALL CABINET**

Quantity: One (1)  
Manufacturer: Advance Tabco (or equal)  
Model: WCH-15-36  
Status: CFCI  
Cabinet, wall mount, enclosed design with (2) hinged doors, 36"W x 15"D, with single intermediate shelf, 18/430 stainless steel construction, NSF

**ITEM #17 SERVING COUNTER**

Quantity: One (1)  
Manufacturer: American Stainless-Steel Corp. (or equal)  
Model: Fabricated Item  
Status: CFCI  
Fabricated assembly in length and configuration as shown on the drawings and shall include the following:

- A. Base section to be 16-gauge stainless steel formed metal construction complete with 16-gauge stainless steel bottom and mid shelves. Work top to be 14-gauge stainless steel with a 14-gauge stainless steel backsplash 1" thick to wall, turn down ½" to "Z-clips" at where counter meets wall.
- B. Top to be constructed with square edge 2" turn down at edge with 1" return on all sides.
- C. Top to be continuous through window with no joints or seams and verify edge is free of sharp edges or burrs.
- D. Provide adjustable seismic flanged feet. Refer to drawings for configuration and quantity.
- E. Provide 16-gauge stainless steel undershelf as shown.
- F. Contractor to verify clearances for roll down door tracks at splash where applicable.
- G. Provide adjustable seismic flanged feet. Refer to drawings for configuration and quantity.

**ITEM #17.1 HOT FOOD WELL UNIT, DROP-IN, ELECTRIC**

Quantity: One (1)  
Manufacturer: Duke Manufacturing  
Model: WWG4  
Status: CFCI  
Waterless Hot Food Well Drop-In Unit, ganged, electric, dry operation, with (4) 12" x 20" hot food well, 60-1/4"W x 24-1/4"D x 12-3/4"H, stainless steel well, removable FDA approved silicone rubber liner, fully insulated galvanized exterior housing, touch screen control panel, without drain, 6' cord & plug, UL, cULus

Accessories:

- 1 ea. Model WWG-4-208 208v/60/1-ph, 9.6 amps, NEMA 6-20

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SACRAMENTO, CALIFORNIA  
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04 JANUARY 2024

**ITEM #17.2 SNEEZE GUARD, STATIONARY**

Quantity: One (1)

Manufacturer: Premier Metal & Glass (or equal)

Model: FM2N-A

Status: CFCI

Adjustable Dual-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, adjustable end panels, front mount, 1" OD round stainless support posts, NSF & cULus listed  
(Contact Premier Sales Department for Pricing)

Accessories:

- 1 ea. 1" OD Stainless Steel tubing (Contact Premier Sales Department for details)
- 1 ea. Brushed (#4) (Contact Premier Sales Department for Pricing), NSF
- 2 ea. Both end panels, reversible (Contact Premier Sales Department for Pricing)

**END SECTION**

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04 JANUARY 2024

SECTION 11 68 00 - PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
1. Playground equipment.
  2. Exterior court athletic equipment
  3. Athletic field equipment.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of equipment.
1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of exposed finish.
1. Manufacturer's color charts.
  2. Include Samples of accessories involving color selection.

1.03 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of equipment that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  2. Warranty Period: Five years from date of Substantial Completion.

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 1



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain equipment from single source from single manufacturer for each type of equipment.
- B. Playground equipment and components shall have the IPEMA Certification Seal.

2.02 PERFORMANCE REQUIREMENTS

- A. Safety Standard: Provide playground equipment according to ASTM F1487.

2.03 COMPOSITE PLAYGROUND EQUIPMENT

- A. Composite Play Structures: Integral play assemblies that provide more than one play activity; manufactured as a system or assembled from manufacturer's standard modular-sized units.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Berliner Seilfabrik.
  - 2. Metal Frame: Galvanized-steel pipe or tubing connected with bolts or clamps.
    - a. Main Frame Posts: Not less than 5-inch OD.
    - b. Color: As selected by Architect from manufacturer's full range.
  - 3. Platforms: Manufacturer's standard.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 4. Roofs: Manufacturer's standard.
    - a. Color: As selected by Architect from manufacturer's full range.
  - 5. Arrangement: As indicated on Drawings.

2.04 EXTERIOR COURT ATHLETIC EQUIPMENT

- A. Volleyball Equipment:
  - 1. Manufacturer: Patterson-Williams Athletic Manufacturing Company.
  - 2. Basis-of-Design Products: As follows:
    - a. Post Assembly: HEAVY DUTY GAME POSTS, Model 2216-21-SPEC.
    - b. Net: MODEL #8361-10 PREMIUM VOLLEYBALL NET, 30' x 3' (6LBS).
- B. Pickleball Equipment:
  - 1. Manufacturer: Patterson-Williams Athletic Manufacturing Company.
  - 2. Basis-of-Design Products: As follows:
    - a. Post Assembly: Model 2202.
      - 1) Color: Green.
    - b. Net: Premium Pickleball Net Model 8354.

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 2

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Basketball Equipment:
1. Basis-of-Design Product: Gooseneck post with backboard, rim, and nylon net.
    - a. Post: L.A. Steelcraft; LA-12C Series with powder coat finish.
      - 1) Size: As selected by Architect from manufacturer's full range.
      - 2) Color: As selected by Architect from manufacturer's full range.
    - b. Backboard: L.A. Steelcraft; LA-11X aluminum with powder coat finish.
    - c. Rim: L.A. Steelcraft; LA-39 aluminum with powder coat finish.
    - d. Net: L.A. Steelcraft; LA-34.
- D. Tetherball Equipment:
1. Basis-of-Design Product: Galvanized, one-piece steel post with chain, snap and ball.
    - a. L.A. Steelcraft; L.A. Steelcraft; TBPCB.
- E. Gaga Ball Pit Barrier:
1. Basis-of-Design Product: Action Play Systems; APS-GagaPit26.
- F. Funnel Ball System:
1. Basis-of-Design Product: Burke; FUN-nel Ball.
  2. Support Post: Galvanized steel with factory finish, 2-3/8 inches in diameter.
  3. Funnel Ball Assembly: Weather resistant fiberglass.

2.05 ATHLETIC FIELD EQUIPMENT

- A. Baseball Equipment:
1. Chainlink Backstop: Galvanized, polymer coated chain link fabric and galvanized, powder coated pipe frame.
  2. Basis-of-Design Product:
    - a. L.A. Steelcraft; LA-1035T-PV.

2.06 FABRICATION

- A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.
- B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

HMC Architects

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- D. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.
- E. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches.
  - 1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F1487.

## 2.07 MATERIALS

- A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.
- B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated[, **hot-dip galvanized**].
- C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.
- D. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.
- E. Suspension Chain and Fittings: ASTM A467/A467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; hot-dip galvanized; with commercial-quality, hot-dip galvanized steel connectors and swing or ring hangers.
- F. Suspension Cable: Manufacturer's standard hot-dip galvanized cable; with commercial-quality, hot-dip galvanized steel connectors and swing or ring hangers and covered with abrasion-resistant polyester yarn.
- G. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.
- H. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

## 2.08 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 4

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.09 IRON AND STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

2.10 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
  - 1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.
- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set with Concrete Footing: Comply with Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.
  - 1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
3. Finishing Footings: Smooth top, and shape to shed water.

END OF SECTION

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PLAY FIELD EQUIPMENT AND  
STRUCTURES  
11 68 00 - 6

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes motor- operated roller shades for windows .

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of roller shade.
  - 1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
  - 2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
  - 3. Installation Accessories: Full-size unit, not less than 10 inches long.
- D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

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ROLLER WINDOW SHADES  
12 24 13 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Draper Inc.
  - 2. Lutron Electronics Co., Inc.
  - 3. MechoShade Systems, Inc.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.02 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
  2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    - a. Maximum Total Shade Width: As required to operate roller shades indicated.
    - b. Maximum Shade Drop: As required to operate roller shades indicated.
    - c. Maximum Weight Capacity: As required to operate roller shades indicated.
  3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    - a. Individual Switch Control Station: Maintained -contact, wall-switch-operated control station with open, close, and center off functions.
      - 1) Switch Positions: Three.
      - 2) Switch Style: Rocker.
    - b. Group Control Station: Maintained -contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
    - c. Individual/Group Control Station: Maintained -contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
    - d. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
    - e. Color: As selected by Architect from manufacturer's full range.
  4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
  5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: As indicated on Drawings.
  2. Direction of Shadeband Roll: As indicated on Drawings.



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- E. Shadebands:
1. Shadeband Material: Light-blocking fabric as indicated on drawings.
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
    - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches.
  2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
    - a. Height: Manufacturer's standard in height required to enclose roller and shadeband assembly when shade is fully open, but not less than as indicated on Drawings.
  3. Endcap Covers: To cover exposed endcaps.
  4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
    - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than height indicated on Drawings.
    - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
  5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
    - a. Closure-Panel Width: As indicated on Drawings.
  6. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
  7. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
  8. Installation Accessories Color and Finish: As selected from manufacturer's full range.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.03 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
  - 1. Source: Roller shade manufacturer.
  - 2. Type: As indicated on Drawings.
  - 3. Color: As indicated on Drawings.

2.04 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
  - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
  - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
  - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

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ROLLER WINDOW SHADES  
12 24 13 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Roller Shade Locations: As indicated on Drawings.

3.03 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 13 34 00 - FABRICATED ENGINEERED STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Fabricated engineered structures including structural framing, secondary framing, and concrete footings of the following type:
1. Shade structures with fabric shades.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of fabricated engineered structure component.
- B. Shop Drawings:
1. Include plans, elevations, sections, structural connection details, and attachment details.
  2. Detail fabrication, assembly, and attachment of shade fabric.
  3. Photovoltaic Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following:
1. Shade Fabric: 12-inch- square section of fabric from dye lot to be used for the Work, with specified treatments applied. Mark face of fabric.
  2. Structural Framing Finish: Not less than 6-inch lengths for each color.
- E. Delegated-Design Submittal: For fabricated engineered structures.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
  2. Name of manufacturer.
  3. Name of Contractor.

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FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

4. Structure dimensions including width, length, height.
5. Governing building code and year of edition.
6. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads.
7. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

D. Sample Warranties: For special warranties.

#### 1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For shade fabric to include in operation and maintenance manuals.

#### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver components so as not to be damaged or deformed. Package for protection during transportation and handling.

#### 1.07 WARRANTY

A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of fabricated engineered structures that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Structural failures including framework.

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FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 2

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- b. Deterioration of fabric including seam failure.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 2. Fabricated Engineered Structure Warranty Period: Five years from date of Substantial Completion.
- 3. Shade Fabric Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Fabricated Engineered Structure: Subject to compliance with requirements, provide US Shade Super Span Hip Shade structure assembly or comparable assembly by an approved manufacturer.
- B. Source Limitations: Obtain system components, including primary and secondary framing and metal support assemblies, from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a structure capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure.
- B. Structural Framing: Manufacturer's standard, consisting of primary frame, capable of supporting design loads.
- C. Secondary-Frame Type: Manufacturer's standard purlins, joists, and girts.

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal building system.
- B. Structural Performance: Fabricated engineered structures shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
  - 1. Design Loads: As indicated on Drawings and in accordance with DSA Pre-Check Design Criteria.
- C. Seismic Performance: Fabricated engineered structures shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and as indicated on drawings.

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3186070000

FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire-Test-Response Characteristics: Provide shade fabrics with the fire-test-response characteristics indicated, as determined by testing identical products according to test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Flame-Resistance Ratings: Passes NFPA 701 and California Code of Regulations, Title 19.
  - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency for Flame-Spread Index of 25 or less.
  - 3. Permanently attach label to each awning fabric indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals, and whether it requires retreatment after designated time period or cleaning.

#### 2.04 STRUCTURAL STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" and as follows:
  - 1. ASTM A-325, Grade B or SAE J249, Grade 8.
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements.
  - 1. Finish: Manufacturer's standard zinc-rich primed and top-coated decorative powder-coat finish complying with finish manufacturer's written instructions.
- E. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from metallic-coated steel sheet, to comply with the following:
  - 1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
    - a. Depth: As needed to comply with system performance requirements.

HMC Architects

3186070000

FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 4

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2. Metal Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips.
- F. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel; designed to withstand required loads.
- G. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, of one of the following materials:
  1. Zinc coated steel.
  2. Stainless steel.
- H. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
  1. Clean and prepare in accordance with SSPC-SP2.
  2. Coat with manufacturer's standard zinc-rich primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
    - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.05 SHADE FABRIC

- A. Fabric:
  1. Product: Gale Pacific Commercial NinetyFive 340FR Knitted HDPE monofilament and tape shade fabric offering a UVE Protection from 90 to 95 percent.
  2. Pattern and Color: As selected by Architect from manufacturer's full range .
- B. Seam Thread: GORE TENARA mildew-resistant sewing thread, manufactured from 100 percent expanded PTFE, UV-light, mildew, and rot resistant.

2.06 CONCRETE MATERIALS

- A. Furnish formwork and formwork accessories according to ACI 301 (ACI 301M).
- B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces without spiral or vertical seams not exceeding specified formwork surface class.
  1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- C. Concrete Reinforcement:
  1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
  2. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

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FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 5



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
4. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Portland Cement: ASTM C 150, Type V.

E. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

F. Water: ASTM C 94/C 94M.

## 2.07 CONCRETE MIXTURES

A. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 (ACI 301M), as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days, minimum.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

## 2.08 ACCESSORIES

A. General: Provide accessories as standard fabricated engineered structure system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

B. Steel Cable and Cable Fittings:

1. Cable: 7-by-19 wire cable made from wire complying with ASTM A1023, galvanized .
2. Cable Diameter: As required to meet performance requirements.
3. Cable Fittings: Connectors of types required, fabricated from stainless or galvanized steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.

## 2.09 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

HMC Architects

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FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 6

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.03 CONCRETE

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301 (ACI 301M).
- B. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- C. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- D. Comply with ACI 301 (ACI 301M) and ACI 318 for placing concrete.
- E. Consolidate concrete with mechanical vibrating equipment.
- F. Finish: Provide smooth, as-cast concrete finish imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch holes and defective areas. Remove fins and other projections exceeding 1/8 inch.

HMC Architects

3186070000

FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 7

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.04 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
- F. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line.
- G. Bracing: Install bracing where indicated on erection drawings.
- H. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.05 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with other components.
  - 1. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

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3186070000

FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 8

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

3.06 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Concrete Tests: Perform according to ACI 301 (ACI 301M).
- C. Installation will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

- A. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
  - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION

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FABRICATED ENGINEERED  
STRUCTURES  
13 34 00 - 9

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 05 10  
PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

1.02 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.03 REFERENCES

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.
- H. See detailed References that are listed in individual sections.

1.04 DESCRIPTION OF WORK

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Plumbing System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of plumbing work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.05 DRAWINGS AND SPECIFICATIONS

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, and other plumbing work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.06 INDUSTRY STANDARDS AND CODES

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.
  - 6. California Fire Code, 2022.
  - 7. California State Fire Marshal.
  - 8. Occupational Safety and Health Administration, including CAL-OSHA.
  - 9. California Energy Code, 2022.
  - 10. California Green Building Standards Code, 2022.
  - 11. State of California Code of Regulations, Title 24.
  - 12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. No material or product installed as a part of the Work shall contain asbestos in any form.
- E. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.

1.07 SITE EXAMINATION

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.08 PERMITS, FEES AND UTILITY SERVICES

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.09 COORDINATION OF WORK

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.
- C. Arrange plumbing work in a neat, well-organized manner with the piping and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Verify the location of all equipment, plumbing devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

1.10 PROGRESS OF WORK

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Plumbing systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Plumbing systems and equipment shall include, but are not limited to, all piping, water heaters, expansion tanks, air compressors, vacuum pumps, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.12 SUBMITTALS

- A. See Section 013300 - Submittals, for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
- G. Maintain a copy of the fire penetration installation instructions on site for use by the Inspector of Record.

1.13 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
  - 4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01700 Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  - 1. Plumbing Systems.
  - 2. Medical Gas Equipment, Piping and Alarm Systems.
  - 3. Piping Systems.
  - 4. Temperature Controls Systems.
  - 5. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of plumbing equipment furnished as a part of the Work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.
- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.15 PROJECT RECORD DOCUMENTS

- A. See Section 017700 - Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of piping. Include notes explaining installed condition for complete understanding.

1.16 QUALITY ASSURANCE

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

1.17 PROJECT CONDITIONS

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.18 WARRANTY

- A. See Section 01700 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 QUALITY AND CARE

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- F. Inspect and report concealed damage to carrier within their required time period.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.02 ACCESS DOORS

- A. Provide access doors where access through floors, walls or ceilings is required to access plumbing equipment and plumbing devices or other systems requiring access for maintenance, test or observation.
  - 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  - 2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- B. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cescio, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
  - 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  - 2. Concealed hinges to allow 175 degree opening.
  - 3. Locks: flush, screw driver operated cam lock(s).
  - 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- C. Application (as applicable):
  - 1. In gypsum drywall walls and ceilings: Type DW.
  - 2. In ceramic tile walls: Type MS (stainless steel).
  - 3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 INSTALLATION

A. Access Doors

1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.03 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
1. Sanitary Sewer, Drain, Vent Piping: Pressure=10 Ft.Hd. / Medium= Water / Duration=4 Hours.
  2. Domestic Water Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.
  3. Condensate drains: Pressure=10 Ft.Hd. / Medium=Water / Duration=4 Hours.
  4. Gas Piping: Pressure=60 Psig / Medium=Air and soap / Duration=8 Hours.

3.04 CUTTING AND PATCHING

- A. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of Project.
  2. Integrity of weather exposed or moisture resistant element.
  3. Efficiency, maintenance, or safety of any operational element.
  4. Visual qualities of sight exposed elements.
  5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.05 PRIMING AND PAINTING

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted, including gas piping outdoors.
  - 1. Primer shall be as recommended by the paint manufacturer for each specific application.
  - 2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 09900 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except piping, or factory primed or finished.
- C. Preparation:
  - 1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
  - 2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  - 3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  - 4. Galvanized Surfaces:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
- b. Apply Devco MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.

5. Uncoated Steel And Iron Surfaces:

- a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
- b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.

6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devco MIRROLAC metal primer or primer recommended by manufacturer.

D. Application:

1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Section 09900.

3.06 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Description:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
  2. Coordinate all testing and startup procedures with all other trades so that all non-plumbing and non-electrical work is completed and operational so that the specified testing can be performed.
- E. Preliminary Work:
1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
    - a. Proper motor and fan/pump rotation.
    - b. Flushing and cleaning of the system.
    - c. Wiring
    - d. Auxiliary connections
    - e. Lubrication.
    - f. Venting.
    - g. Controls.
    - h. Installation of filters and strainers.
    - i. Setting of relief and safety valves .
  2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
  3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Plumbing equipment. This schedule shall include work on a system by system, floor by floor basis.
  4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    - a. The startup checklist will cover all related crafts, e.g., controls, electrical, plumbing, and a clean environment for equipment startup.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.

F. Startup and Commissioning:

1. System Startup and Operation:
  - a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.

END OF SECTION 22 05 10

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 05 16  
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion/seismic loops and compensators.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 22.
- D. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. EJMA (STDS) - EJMA Standards Tenth Edition.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data:
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Loops/Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Maintenance Data: Include adjustment instructions.
- D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.05 REGULATORY REQUIREMENTS

- A. Conform to UL and FM requirements.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
  - 1. Mercer Rubber Company: [www.mercer-rubber.com/#sle](http://www.mercer-rubber.com/#sle).
  - 2. The Metraflex Company: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
- B. Inner Hose: Stainless steel.
- C. Exterior Sleeve: Single braided, stainless steel.
- D. Pressure Rating: 125 psi up to 12 inch.
- E. Maximum Service Temperature: 450 degrees F.
- F. Joint: Flanged or threaded with union.
- G. Size: Use pipe sized units.
- H. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturers:
  - 1. Mercer Rubber Company: [www.mercer-rubber.com/#sle](http://www.mercer-rubber.com/#sle).
  - 2. The Metraflex Company: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi up to 2 inch.
- E. Maximum Service Temperature: 450 degrees F.
- F. Joint: Flanged or threaded with union.
- G. Size: Use pipe sized units.
- H. Maximum offset: 3/4 inch on each side of installed center line.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

I. Application: Copper piping.

2.03 EXPANSION LOOPS

A. Manufacturers:

1. Metraflex Metraloop.
2. Twin Cities Hose Seismic 'V' Connector.

B. Provide flexible expansion loops of size to match piping in which installed as shown on the Drawings.

C. Flexible loops shall be designed to impart no thrust loads on the pipe anchors.

D. The loop shall consist of two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return. Hose and braid shall be T304 stainless steel. Fittings shall be carbon steel. Provide connection ends to match piping fitting requirements.

E. Expansion loops shall be designed for 4 inches of movement in all directions and 4" axial movement. Maximum working pressure 150 PSI at 70 degrees.

F. Install at all locations where piping crosses building seismic expansion joints.

G. Expansion loops shall be certified for fluid/gas being transported for use in seismic applications.

2.04 EXPANSION LOOPS - HOSE AND BRAID

A. Manufacturers:

1. The Metraflex Company; Metraloop: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
2. Unisource Manufacturing, Inc; V-Loop: [www.unisource-mfg.com/#sle](http://www.unisource-mfg.com/#sle).

B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.

C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.

D. Maximum Working Pressure: 150 psi at 800 degrees F.

E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Selected Product to Accommodate:
  - a. Angular Rotation: 15 degrees.
  - b. Force developed by 1.5 times specified maximum allowable operating pressure.
2. Provide necessary accessories including, but not limited to, swivel joints.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Anchor pipe to building structure where indicated or required. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- F. Install seismic expansion loops at all points where piping crosses building expansion joints.

END OF SECTION 22 05 16



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 05 23  
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. Angle valves.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Gate valves.
- G. Globe valves.
- H. Lubricated plug valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- B. Section 22 07 19 - Plumbing Piping Insulation.
- C. Section 22 10 05 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

I. TFE: Tetrafluoroethylene.

J. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.

G. ASME B31.9 - Building Services Piping 2020.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.

I. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.

J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2023).

K. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).

L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

M. AWWA C606 - Grooved and Shouldered Joints 2022.

N. MSS SP-45 - Drain and Bypass Connections 2020.

O. MSS SP-67 - Butterfly Valves 2022.

P. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends 2011.

Q. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends 2018.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- R. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- S. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.
- T. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- U. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends 2011.
- V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- W. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided 2018.
- X. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- Y. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
  - 1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
1. Shutoff: Ball, butterfly, gate or plug.
  2. Throttling: Provide globe, angle, ball, or butterfly.
  3. Swing Check (Pump Outlet):
    - a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
    - c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- C. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
    - a. 2 inch and Smaller: Threaded ends.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
    - c. Grooved-End Steel Piping: Grooved.
  2. Copper Tube:
    - a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- D. Domestic, Hot and Cold Water Valves:
1. All sizes:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Bronze and Brass: Provide with solder-joint or threaded ends.
- b. Bronze Angle: Class 125, bronze disc.
- c. Ball: Two piece, full port, brass with brass trim.
- d. Bronze Swing Check: Class 125, bronze disc.
- e. Bronze Gate: Class 125, NRS.

E. Gas Valves:

1. All sizes:
  - a. Bronze: Provide with threaded ends.
  - b. Ball: One piece, full port, bronze with bronze trim.
  - c. Lubricated Plug: Class 125, regular gland.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  1. Gear Actuator: Quarter-turn valves 8 inch and larger.
  2. Handwheel: Valves other than quarter-turn types.
  3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
  4. Wrench: Plug valves with square heads.
- D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
  1. Gate Valves: Rising stem.
  2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  3. Butterfly Valves: Extended neck.
  4. Memory Stops: Fully adjustable after insulation is installed.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G. Potable Water Use:

1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.03 BRONZE, ANGLE VALVES

A. Class 125; CWP Rating: 200 psi:

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. End Connections: Pipe thread.
4. Stem: Bronze.
5. Disc: Bronze.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.04 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Threaded or Soldered Connections:

1. Comply with MSS SP-110.
2. Seats: PTFE.
3. Ball: Chrome-plated brass.

2.05 BRONZE, BALL VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim:

1. Comply with MSS SP-110.
2. WSP Rating: 150 psi.
3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze, blowout proof.
8. Ball: Chrome plated brass.

2.06 BRONZE, LIFT CHECK VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. CWP Rating: 200 psi.
3. Design: Vertical flow.
4. Body: Comply with ASTM B61 or ASTM B62, bronze.
5. End Connections: Threaded.

2.07 BRASS, INLINE CHECK VALVES

- A. Class 150:
- B. Maximum Service Temperature: 250 degrees F.
- C. Body: Forged brass.
- D. Disc: Forged brass.
- E. Seal: PTFE, bubble-tight.
- F. End Connections: Press.

2.08 BRASS, HORIZONTAL SWING CHECK VALVES

- A. Class 125, Threaded End Connections:
  1. WOG Rating: 200 psi.
  2. Body: Forged brass.
  3. Disc: Forged brass.
  4. Hinge-Pin, Screw, and Cap: Forged brass.

2.09 BRONZE, SWING CHECK VALVES

- A. General:
  1. Fabricate from dezincification resistant material.
  2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
  1. Pressure and Temperature Rating: MSS SP-80, Type 3.
  2. Design: Y-pattern, horizontal or vertical flow.
  3. WOG Rating: 200 psi.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Body: Bronze, ASTM B62.
5. End Connections: Threaded.
6. Disc: Bronze.

2.10 BRONZE, GATE VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. NRS (Non-rising Stem) or OS & Y (Rising Stem):

1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating 200 psig.
3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint joint.
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

2.11 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psi.
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
  - 1. Lift Check: Install with stem plumb and vertical.
  - 2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 22 05 23

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
  - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
  - 1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  - 2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
  - a. Equipment Supports: 1/2 inch diameter.
  - b. Piping up to 4 inch: 3/8 inch diameter.
  - c. Piping larger than 4 inch: 1/2 inch diameter.
  - d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:

1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

A. J-Hangers, Adjustable:

1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:

1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Clevis Hangers, Adjustable:

1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.05 PIPE CLAMPS

A. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

B. Extension Split Pipe Clamp:

1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

D. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

E. Insulation Coupling:

1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

2.06 PIPE ROLLERS AND ROLLER SUPPORTS

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides, Galvanized steel:
  1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:
  1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. General Construction and Requirements:

- a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
- b. Shields Material: UV-resistant polypropylene with glass fill.
- c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
- d. Service Temperature: Minus 40 to 178 degrees F.
- e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:

1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
  - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
  - b. Support From Below: MSS SP-58 types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
  - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
  - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
  - c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:

1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
  - b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
- d. Provide pipe supports for 1/2 to 30 inch iron pipes.
- e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.

2. PVC Jacket:

- a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
- b. Minimum Service Temperature: Minus 40 degrees F.
- c. Maximum Service Temperature: 180 degrees F.
- d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
- e. Minimum Thickness: 60 mil, 0.06 inch.

2.08 SEISMIC BRACING HARDWARE

A. Cable Sway Bracing Systems:

- 1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
- 2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

2.09 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

- A. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- B. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
- C. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

2.10 ANCHORS AND FASTENERS

- A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
- B. Concrete: Use preset concrete inserts or expansion anchors.
- C. Solid or Grout-Filled Masonry: Use expansion anchors.
- D. Hollow Masonry: Use toggle bolts.
- E. Hollow Stud Walls: Use toggle bolts.
- F. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- G. Sheet Metal: Use sheet metal screws.
- H. Wood: Use wood screws.
- I. Plastic and lead anchors are not permitted.
- J. Powder-actuated fasteners are not permitted.
- K. Hammer-driven anchors and fasteners are not permitted.
- L. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- M. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners according to manufacturer's recommended torque settings.
- K. Remove temporary supports.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 05 29

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 05 53  
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Heat Transfer Equipment: Nameplates.
- B. Major Control Components: Nameplates.
- C. Piping: Pipe markers.
- D. Pumps: Nameplates.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Small-sized Equipment: Tags.
- F. Tanks: Nameplates.
- G. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- H. Water Treatment Devices: Nameplates.

2.02 MANUFACTURERS

- A. Brady Corp.
- B. Seton Identification Products.

2.03 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.
  - 4. Plastic: Comply with ASTM D709.

2.04 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.05 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- C. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- D. Identify domestic hot water heating equipment, including pumps, etc. with plastic nameplates.
- E. Identify valves in main and branch piping with tags.
- F. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Identify all medium pressure gas piping (over 11" W.C. to 5 PSI pressure) with pressure contained within piping system (for example: "MPG 5 PSI")

END OF SECTION 22 05 53



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 07 19  
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation.
- B. Piping insulation.
- C. Glass fiber insulation.
- D. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation 2017 (Reapproved 2023).
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.
- G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing 2022.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2023).
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER INSULATION

A. Manufacturers:

1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
2. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
3. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' value: ASTM C 177, 0.22 to 0.28 at 100 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Armacell LLC; AP Armaflex: [www.armacell.us/#sle](http://www.armacell.us/#sle).
2. K-Flex USA LLC; Insul-Tube: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
3. Owens Corning Flex Tubing

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible and sheet for equipment and other surfaces.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
  2. Minimum Service Temperature: Minus 40 degrees F.
  3. Maximum Service Temperature: 220 degrees F.
  4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
  5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
  6. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive:
- D. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

2.04 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
1. Manufacturers:
    - a. Proto Corporation, Proto-Wrap 30 LoSmoke.
    - b. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil, 0.010 inch.
    - e. Connections: Brush on welding adhesive.
  3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with molded PVC fitting covers.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with molded PVC fitting covers.
- E. Inserts and Shields:
  1. Application: Piping 1-1/2 inches diameter or larger.
  2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  3. Insert Location: Between support shield and piping and under the finish jacket.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, use a UL rated fire penetration assembly, 3M or equal.
- G. Pipe in Supply Air Plenum or Finished Spaces: Finish with PVC jacket and fitting covers.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.
- I. Exterior Applications (exposed to the weather): Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### 3.03 SCHEDULES

#### A. Plumbing Systems:

1. Domestic Hot and Tempered Water Supply:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: 1-1/2 inch and larger.
      - (a) Thickness: 2 inch.
    - 2) Pipe Size Range: 1 inch and smaller.
      - (a) Thickness: 1-1/2 inch.
2. Domestic Cold Water Located in Unheated Areas:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: 1-1/2 inch and larger.
      - (a) Thickness: 1 inch.
    - 2) Pipe Size Range: 1 inch and smaller.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

(a) Thickness: 3/4 inch.

END OF SECTION 22 07 19

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 10 05  
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Drains.
- D. Domestic water piping, buried within 5 feet of building.
- E. Domestic water piping, above grade.
- F. Natural gas piping, above grade.
- G. Pipe flanges, unions, and couplings.
- H. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- D. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- F. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV 2021.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV 2022.
- H. ASME B31.1 - Power Piping 2022.
- I. ASME B31.9 - Building Services Piping 2020.
- J. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2023.
- K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- L. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.
- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023a.
- N. ASTM B32 - Standard Specification for Solder Metal 2020.
- O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- P. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- Q. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV) 2020.
- R. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- S. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- U. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- V. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).
- W. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- X. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- Z. MSS SP-67 - Butterfly Valves 2022.
- AA. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- BB. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- CC. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- DD. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California, standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.
- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.

2.03 DRAIN PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.
- C. Copper Tube: ASTM B 306, DWV or ASTM B 88 (ASTM B 88M), Type M (C), Drawn (H).
  - 1. Application: Condensate drains inside building (non-acidic).
  - 2. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.
  - 3. Joints: ASTM B32, alloy Sn50 solder.
- D. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40, galvanized.
  - 1. Application: Condensate drains outside building (non-acidic).
  - 2. Threaded Joints: ASME B16.3 malleable iron fittings.
- E. PVC Pipe: ASTM D2665.
  - 1. Application: Condensate drains (acidic).
  - 2. Fittings: PVC.
  - 3. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 WATER PIPING, BURIED

- A. Copper Pipe: ASTM B 42, hard drawn, Type K.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
  - 2. Joints: ASTM B32, alloy Sn95 solder.
  - 3. Joints: For sizes 2" and larger, AWS A5.8M/A5.8, BCuP copper and silver braze.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
  - 1. Fittings: ASME B16.18, cast copper alloy.
  - 2. Joints: For sizes 1-1/2" and smaller, ASTM B 32, alloy Sn95 solder.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Joints: For sizes 2" and larger, AWS A5.8, BCuP5 silver braze.
- B. Provide full solder cup for all fittings.
- C. Schedule 40 Screwed Brass: Capped or plugged outlets.

2.06 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Pipe size 2" and smaller: Malleable iron threaded fittings.
  2. Pipe size 2-1/2" and larger: Steel butt welded fittings.
  3. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
  4. Joints: Threaded or welded to ASME B31.1.
- B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
  2. Comply with ASTM E84.
  3. Fittings: Provided by piping system manufacturer.

2.07 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 2 Inches and Under:
1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 2 inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.08 PIPE HANGERS AND SUPPORTS

- A. See Section 22 05 29 for additional requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.09 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure:
  - 1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.10 STRAINERS

- A. Size 2 inch and Smaller:
  - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Provide anodeless transition riser at gas piping transition from below grade to above grade.
- J. All natural gas piping exposed to outdoors shall be primed and painted, color by architect.
- K. All ABS and PVC pipe material exposed to outdoors shall be primed and painted, color by architect.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
- M. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.
- N. Install water piping to ASME B31.9.
- O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- P. Sleeve pipes passing through partitions, walls, and floors.
- Q. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as indicated.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Provide copper plated hangers and supports for copper piping.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
8. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.07 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

- a. Pipe Size: 1/2 inch to 1-1/4 inch:
  - 1) Maximum Hanger Spacing: 6.5 ft.
  - 2) Hanger Rod Diameter: 3/8 inches.
- b. Pipe Size: 1-1/2 inch to 2 inch:
  - 1) Maximum Hanger Spacing: 10 ft.
  - 2) Hanger Rod Diameter: 3/8 inch.
- c. Pipe Size: 2-1/2 inch to 3 inch:
  - 1) Maximum Hanger Spacing: 10 ft.
  - 2) Hanger Rod Diameter: 1/2 inch.
- d. Pipe Size: 4 inch to 6 inch:
  - 1) Maximum Hanger Spacing: 10 ft.
  - 2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION 22 10 05

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 10 06  
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Floor drains.
- B. Cleanouts.
- C. Water hammer arrestors.
- D. Trap primers.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor Drains 2022.
- B. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- C. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- D. NSF 372 - Drinking Water System Components - Lead Content 2022.
- E. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 REFER TO PLUMBING SCHEDULE FOR PLUMBING PIPING SPECIALTIES NOT LISTED HEREIN.

2.03 DRAINS

- A. Manufacturers:
  1. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).
  2. MIFAB, Inc: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  3. Jay R. Smith Manufacturing Company.
  4. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

B. Downspout Nozzles:

1. Bronze round with straight bottom section. Zurn Z-199.

C. Floor Drain (FD):

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
2. Provide accessories suitable for wood raised floor installation.

D. Floor Sink (FS):

1. Lacquered cast iron body with white acid resisting porcelain interior and top complete with aluminum anti-splash bottom dome strainer, square slotted medium duty half grate, anchor and seepage flange.

2.04 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).
3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).

B. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas :

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and nickel bronze round gasketed scored cover in service areas and round or square nickel bronze gasketed depressed cover to accept floor finish in finished floor areas. Zurn ZN-1400.

E. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw. Zurn Z-1441 or Z-1443.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Cleanouts in concealed aboveground cast iron soil or waste lines: Zurn Z-1440A with raised head ABS plastic plug.

2.05 TRAP PRIMERS

- A. Provide trap primers, 1/2 inch size, where indicated on drawings. Provide with built-in air gap and install 1/2" shutoff valve. PVC housings are not acceptable. Install trap primer line with 1/4" per foot slope to insure full drainage to floor drain or floor sink. Install trap primer behind wall with access door.
- B. Provide a distribution unit with feeder piping for a maximum of four (4) traps where multiple traps are serviced by a single trap primer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface as indicated on plans. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install cleanouts in all horizontal soil and waste piping at 100 feet maximum spacing inside building, 100 feet maximum spacing outside building, at every 135 degree change of direction and where shown on Drawings.
- E. Install two way cleanout in building drain (waste line leaving the building) just outside of the building.
- F. Install cleanouts in waste drops from each urinal and sink.
- G. Install cleanouts in rain water (storm drain) drops 18 inches above finished floor. For concealed rainwater drops extend cleanout to building exterior for access.
- H. Install floor cleanouts at elevation to accommodate finished floor.
- I. Pipe relief from backflow preventer to nearest drain.
- J. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatoriessinks and washing machine outletswater closets and as shown on plans.

END OF SECTION 22 10 06

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 30 00  
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial gas-fired water heaters.
- B. Expansion Tanks.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 018114 Sustainable Design Requirements (CHPS).
- C. Section 019113 General Commissioning Requirements.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less 2019, with Errata (2020).
- B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous 2019.
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2023.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.
- G. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  2. Indicate pump type, capacity, power requirements.
  3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
  4. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. See Section 01700 - Contract Closeout, for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Commercial Gas-Fired Water Heaters:
  1. Manufacturers:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Bradford White Corporation: [www.bradfordwhite.com/#sle](http://www.bradfordwhite.com/#sle).
  - b. A.O. Smith Water Products Co<>: [www.hotwater.com/#sle..](http://www.hotwater.com/#sle..)
  - c. State Water Heaters: [www.statewaterheaters.com](http://www.statewaterheaters.com).
2. Type: Automatic, natural gas-fired condensing type, vertical storage, power-direct vent.
  3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
  4. Ultra Low-Nox type complying with SCAQMD Rule 1146.2.
  5. Shall meet thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IES 90.1.
  6. Accessories:
    - a. Water Connections: Brass.
    - b. Dip Tube: Brass.
    - c. Drain valve.
    - d. Anode: Magnesium.
    - e. Temperature and Pressure Relief Valve: ASME labeled.
    - f. Acid Neutralizer Kit
    - g. Concentric Vent Kit

2.02 **EXPANSION TANK**

- A. Manufacturers:
  1. Amtrol Inc: [www.amtrol.com/#sle](http://www.amtrol.com/#sle).
  2. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  3. Taco, Inc: [www.tacocomfort.com/#sle](http://www.tacocomfort.com/#sle).
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 38 psig.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.
- C. Provide and install CPVC piping for combustion air intake and flue for gas fired water heaters where scheduled and as shown on the drawings. Install in accordance with manufacturer's installation instructions.

END OF SECTION 22 30 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 22 40 00  
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sinks.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping.
- C. Section 22 10 06 - Plumbing Piping Specialties.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration 2008 (Reaffirmed 2013).
- B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- C. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- D. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- E. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2022.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- G. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- H. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on-site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

- A. See Section 01700 - Contract Closeout, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 GENERAL REQUIREMENTS:

- A. Refer to Architectural drawings for exact locations, fixture mounting heights and ADA accessibility requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Insulate domestic hot water, tempered water and waste piping below handicapped plumbing fixtures with molded single piece removable insulation covers, foam, fire resistant, Truebro, or equal. Install insulation covers in accordance with ADA requirements.
- C. Provide 85% IPS red brass pipe for each connection to faucets, stops, hose bibs, and other fixtures/trim. Securely anchor brass pipe to structure. Install stop valves on water supply lines for each fixture, except hose bibbs.
- D. Provide compression shutoff control stop valves with IPS inlets and threaded brass nipples at pipe connection on water supplies to each fixture. Provide stops with lock shield loose key and key handle for each stop. For combination fixtures, provide with compression stop and IPS inlet on each water supply fitting.
- E. Provide cast brass escutcheons, except escutcheons exposed to view shall have chrome plated finish.
- F. Provide chromium-plated finish on fittings and accessories exposed to view.
- G. Fixture fittings and trim: Conform to ASME A112.18.1M and ASME A112.19.5, as applicable.
- H. Centerset faucets: Top-mounted with inlets on not greater than 4 inch centers, unless specified otherwise below.
- I. Separate faucets and combination supply fittings: Provide inlets on 8 inch centers.
- J. Zinc-alloy or plastic handles are not permitted for faucets and valves.
- K. Provide special roughing-in for wheelchair fixtures.
- L. Lavatory flow rates not to exceed 0.5 GPM.
- M. Water closet flush flow rates not to exceed 1.28 GPF.
- N. Urinal flush flow rates not to exceed 0.125 GPF.
- O. Provide water hammer arrestors at end of pipe runs to two or more fixtures, properly sized with sufficient displacement volume to dissipate calculated energy in the piping systems. Locate in accessible location or provide access panel with location approved by Architect.
- P. Fixture dimensions specified are nominal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.03 SEE PLUMBING SCHEDULE FOR FIXTURE REQUIREMENTS.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

3.04 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

- A. Clean plumbing fixtures and equipment.

END OF SECTION 22 40 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 05 10  
MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

1.02 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.03 REFERENCES

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.
- H. See detailed References that are listed in individual sections.

1.04 DESCRIPTION OF WORK

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

1.05 DRAWINGS AND SPECIFICATIONS

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

1.06 INDUSTRY STANDARDS AND CODES

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.
  - 6. California Fire Code, 2022.
  - 7. California State Fire Marshal.
  - 8. Occupational Safety and Health Administration, including CAL-OSHA.
  - 9. California Energy Code, 2022.
  - 10. California Green Building Standards Code, 2022.
  - 11. State of California Code of Regulations, Title 24.
  - 12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. No material or product installed as a part of the Work shall contain asbestos in any form.

1.07 SITE EXAMINATION

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

1.08 PERMITS, FEES AND UTILITY SERVICES

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

1.09 COORDINATION OF WORK

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.
- C. Arrange mechanical work in a neat, well-organized manner with the piping, conduit, and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.
- D. Verify the location of all equipment, and devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.10 PROGRESS OF WORK

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

- A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Mechanical systems and equipment shall include, but are not limited to, all piping, heating and ventilating equipment, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

1.12 SUBMITTALS

- A. See Section 013300 - Submittal Procedures, for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
- G. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

1.13 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
  - 4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01700 Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  - 1. Ventilating Systems.
  - 2. Air Conditioning Systems.
  - 3. Piping Systems.
  - 4. Temperature Controls Systems.
  - 5. Motors.
  - 6. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.
- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.
- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

1.15 PROJECT RECORD DOCUMENTS

- A. See Section 017700 - Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of ductwork. Include notes explaining installed condition for complete understanding.

1.16 QUALITY ASSURANCE

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

1.17 PROJECT CONDITIONS

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.18 WARRANTY

- A. See Section 01700 - Closeout Procedures, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 QUALITY AND CARE

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- F. Inspect and report concealed damage to carrier within their required time period.
- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

2.02 ACCESS DOORS

- A. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- B. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  2. Concealed hinges to allow 175 degree opening.
  3. Locks: flush, screw driver operated cam lock(s).
  4. Provide anchoring devices suitable for the construction into which the doors are framed.
- C. Application (as applicable):
1. In gypsum drywall walls and ceilings: Type DW.
  2. In ceramic tile walls: Type MS (stainless steel).
  3. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Access Doors

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

3.03 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic piping and duct testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
  3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.

3.04 CUTTING AND PATCHING

- A. Submit written request in advance of cutting or alteration which affects:



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Structural integrity of any element of Project.
  2. Integrity of weather exposed or moisture resistant element.
  3. Efficiency, maintenance, or safety of any operational element.
  4. Visual qualities of sight exposed elements.
  5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements, to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.05 PRIMING AND PAINTING

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted to match Architectural finish requirements.
1. Primer shall be as recommended by the paint manufacturer for each specific application.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 092216 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.
- C. Preparation:
1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
  2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devco KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  4. Galvanized Surfaces:
    - a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
    - b. Apply Devco MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
  5. Uncoated Steel And Iron Surfaces:
    - a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
    - b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
  6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devco MIRROLAC metal primer or primer recommended by manufacturer.
- D. Application:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

E. Finish Painting: See Section 09900.

3.06 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Description:
  1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
  2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.
- E. Preliminary Work:
  1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
    - a. Proper motor and pump rotation.
    - b. Flushing and cleaning of the system.
    - c. Wiring
    - d. Auxiliary connections
    - e. Lubrication.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- f. Venting.
  - g. Controls.
  - h. Installation of filters and strainers.
  - i. Setting of relief and safety valves .
- 2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
  - 3. The Contractor shall submit at least 10 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.
  - 4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    - a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.
  - 5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
  - 6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.
- F. Startup and Commissioning:
- 1. System Startup and Operation:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.

END OF SECTION 23 05 10

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2022).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of mechanical work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
  - 1. Indoor Dry Locations: Use approved equivalent or galvanized steel unless otherwise indicated.
  - 2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
  - 1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  - 2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
  - 1. Threaded zinc-plated steel unless otherwise indicated.
  - 2. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Piping up to 4 inch: 3/8 inch diameter.
- c. Piping larger than 4 inch: 1/2 inch diameter.
- d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:

- 1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

A. J-Hangers, Adjustable:

- 1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
- 2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

B. Swivel Ring Hangers, Adjustable:

- 1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
- 2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- 3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Clevis Hangers, Adjustable:

- 1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
- 2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.05 PIPE CLAMPS

A. Riser Clamps:

1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

B. Extension Split Pipe Clamp:

1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

D. Strut Clamps:

1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.

E. Insulation Coupling:

1. Two bolt-type clamps designed for installation under insulation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Material: Carbon steel with epoxy copper or zinc finish.

2.06 PIPE ROLLERS AND ROLLER SUPPORTS

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
- C. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides, Galvanized steel:
  1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:
  1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  2. General Construction and Requirements:
    - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Shields Material: UV-resistant polypropylene with glass fill.
- c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
- d. Service Temperature: Minus 40 to 178 degrees F.
- e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:

- 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- 2. Liquid Temperatures Up to 122 degrees F:
  - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
  - b. Support From Below: MSS SP-58 types 35 through 38.
- 3. Operating Temperatures from 122 to 446 degrees F:
  - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
  - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
  - c. Sliding Support: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:

- 1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
  - b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
  - c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
  - d. Provide pipe supports for 1/2 to 30 inch iron pipes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.

2. PVC Jacket:

- a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
- b. Minimum Service Temperature: Minus 40 degrees F.
- c. Maximum Service Temperature: 180 degrees F.
- d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
- e. Minimum Thickness: 60 mil, 0.06 inch.

2.08 SEISMIC BRACING HARDWARE

A. Cable Sway Bracing Systems:

- 1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
- 2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

2.09 ANCHORS AND FASTENERS

- A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
- B. Concrete: Use preset concrete inserts or expansion anchors.
- C. Solid or Grout-Filled Masonry: Use expansion anchors.
- D. Hollow Masonry: Use toggle bolts.
- E. Hollow Stud Walls: Use toggle bolts.
- F. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- G. Sheet Metal: Use sheet metal screws.
- H. Wood: Use wood screws.
- I. Plastic and lead anchors are not permitted.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- J. Powder-actuated fasteners are not permitted.
- K. Hammer-driven anchors and fasteners are not permitted.
- L. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- M. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners according to manufacturer's recommended torque settings.
- K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 23 05 29

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 05 53  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Control Panels: Nameplates.
- C. Major Control Components: Nameplates.
- D. Piping: Pipe markers.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

E. Small-sized Equipment: Tags.

F. Thermostats: Nameplates.

2.02 MANUFACTURERS

A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).

B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: Air Handling Units, Control panels: 1 inch.
3. Letter Height: All others: 1/4 inch.
4. Background Color: Black.
5. Plastic: Comply with ASTM D709.

2.04 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.05 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.

C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Identify fans and filter boxes with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify chilled/hot water equipment, including chillers, boilers, pumps, expansion tanks, air separators, etc. with plastic nameplates.
- F. Identify air conditioning units, air handling units, heating and ventilating units, exhaust fans, pumps, heat transfer equipment, tanks, fire/smoke damper access doors, and water treatment devices with nameplates. Small devices, such as terminal units, in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify thermostats/sensors relating to fan unit and/or zone unit with nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 05 53

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems 2019.
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component and include controls contractor to assist in testing, adjusting, and balancing procedures. Submit plan for each phase.
  - 1. Submit to LP Consulting Engineers, Inc..
  - 2. Submit to the Commissioning Authority.
  - 3. Submit four weeks prior to starting the testing, adjusting, and balancing work.
  - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the LP Consulting Engineers, Inc. and other installers to sufficiently understand the design intent for each system.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Include at least the following in the plan:
  - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - b. List of all air flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - c. Completed planned test sheets listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
  - d. Single-line drawings with system test locations.
  - e. Identification and types of measurement instruments to be used and their most recent calibration date.
  - f. Detailed step-by-step procedures for TAB work for each system and issue, including:
    - 1) SA, RA, EA, OA, for each AHU.
    - 2) Economizer proportioning and vfd speed adjustments.
    - 3) Rechecking.
  - g. Confirmation of understanding of the outside air ventilation criteria under all conditions.
  - h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
  - i. Method of checking building static and exhaust fan and/or relief damper capacity.
  - j. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  1. Submit to LP Consulting Engineers, Inc. within 2 days after completion of testing, adjusting, and balancing.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
4. Units of Measure: Report data in I-P (inch-pound) units only.
5. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
6. Include the following on the title page of each report:
  - a. Name of Testing, Adjusting, and Balancing Agency.
  - b. Address of Testing, Adjusting, and Balancing Agency.
  - c. Telephone number of Testing, Adjusting, and Balancing Agency.
  - d. Project name.
  - e. Project location.
  - f. Project Engineer.
  - g. Project altitude.
  - h. Report date.
- D. Test and balance shall be performed by an independent test and balance agency.
- E. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- F. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC or NEBB.
- G. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the .

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. SMACNA (TAB).
- B. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- C. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Having minimum of three years documented experience.
  - 3. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org/#sle](http://www.tabbcertified.org/#sle).
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 TESTING, ADJUSTING, AND BALANCING AGENCIES

- A. RS Analysis Inc.; [www.rsanalysis.com](http://www.rsanalysis.com); (888-330-1935).
- B. Mesa 3; [www.mesa3.com](http://www.mesa3.com); (408-928-3000).
- C. Raglen System Balance; [www.raglensystembalance.com](http://www.raglensystembalance.com); (775-747-0100).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.03 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 4. Duct systems are clean of debris.
  - 5. Fans are rotating correctly.
  - 6. Fire and volume dampers are in place and open.
  - 7. Air coil fins are cleaned and combed.
  - 8. Access doors are closed and duct end caps are in place.
  - 9. Air outlets are installed and connected.
  - 10. Hydronic systems are flushed, filled, and vented.
  - 11. Pumps are rotating correctly.
  - 12. Proper strainer baskets are clean and in place.
  - 13. Service and balance valves are open.
- B. Contractor to inspect ductwork and piping systems at 60% and 90% completion to verify systems are ready for testing and balancing.
- C. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- D. Beginning of work means acceptance of existing conditions.

3.04 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to LP Consulting Engineers, Inc. to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.05 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust total airflow(s) to within plus 10 percent and minus 5 percent of design.
- B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus 10 percent and minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus 10 percent and minus 5 percent of design.

3.06 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
  - 1. Running log of events and issues.
  - 2. Discrepancies, deficient or uncompleted work by others.
  - 3. Contract interpretation requests.
  - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.07 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

3.08 TITLE 24 TESTING

- A. Complete applicable Title 24 Acceptance Testing as delineated in contract drawings.

3.09 SCOPE

- A. Test, adjust, and balance the following:
  - 1. Air Handling Units.
  - 2. Fans.
  - 3. Air Filters.
  - 4. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
  - 1. Manufacturer.
  - 2. Model/Frame.
  - 3. HP/BHP.
  - 4. Phase, voltage, amperage; nameplate, actual, no load.
  - 5. RPM.
  - 6. Service factor.
  - 7. Starter size, rating, heater elements.
  - 8. Sheave Make/Size/Bore.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

B. Cooling Coils:

1. Location.
2. Service.
3. Manufacturer.
4. Air flow, design and actual.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
9. Saturated suction temperature, design and actual.
10. Air pressure drop, design and actual.

C. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

14. Fan RPM.
- D. Return Air/Outside Air/Exhaust Air:
1. Identification/location.
  2. Design air flow (determined by initial test)
  3. Actual air flow.
  4. Design return air flow (determined by initial test)
  5. Actual return air flow.
  6. Design outside air flow (determined by initial test)
  7. Actual outside air flow.
  8. Return air temperature.
  9. Outside air temperature.
  10. Actual mixed air temperature.
- E. Duct Traverses:
1. System zone/branch.
  2. Duct size.
  3. Area.
  4. Design velocity.
  5. Design air flow.
  6. Test velocity.
  7. Test air flow.
  8. Duct static pressure.
  9. Air temperature.
  10. Air correction factor.

END OF SECTION 23 05 93

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 07 13  
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings: Ductwork.

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Owens-Corning Fiberglas; Model [All Service Faced Duct Wrap].
2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Duct Application: 2" thick, 3/4 pound density.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Density: 3.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.04 JACKETING AND ACCESSORIES

A. Aluminum Jacket:

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.020 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.05 DUCT LINER

A. Manufacturers:

1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
4. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.

1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
2. Duct Application (Indoors): 1" thick, 1-1/2 pound density.
3. Duct Application (Outdoors): 2" thick, 1-1/2 pound density.
4. Service Temperature: Up to 250 degrees F.
5. Acoustical Requirements
  - a. Sound absorption coefficients of the material (with and/or without erosion resistive coating) shall be greater than or equal to the coefficients listed in the specifications when tested under the specified conditions.
  - b. All acoustical measurements shall be performed in accordance with ANSI/ASTM C423 and shall be performed in the ASTM E795 mounting configuration as indicated.
  - c. An independent acoustical laboratory shall perform the tests.
  - d. The sound absorption coefficient provided by the material shall meet or exceed the following values in each octave band listed:
6. Thickness, 1 inch Hz/Coefficient: 125/.05, 250/.20, 500/.65, 1k/.90, 2k/.95, 4k/.95.

C. Liner Fasteners: Galvanized steel, welded with integral head.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated Ducts Conveying Air Below Ambient Temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated Ducts Conveying Air Above Ambient Temperature:
  - 1. Provide with or with standard vapor barrier jacket.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Duct and Plenum Liner Application:
  - 1. Adhere insulation with adhesive for 100 percent coverage.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Secure insulation with mechanical liner fasteners. Liner shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints, and shall be spaced at a maximum of 12 inches on center around the perimeter of the duct (except that they shall be a maximum of 12 inches from a corner break). Elsewhere, they shall be a maximum of 18 inches on center, except that they shall not be placed more than 6 inches from a longitudinal joint of the liner or 12 inches from a corner break. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
3. Seal and smooth joints. Seal and coat transverse and longitudinal joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are inside dimensions and do not include consideration for liner thickness.

3.03 SCHEDULES

- A. Supply and Return Ducts: Insulate all unlined supply ducts, except ducts exposed in conditioned spaces.
- B. Exterior Applications:
  1. Supply and Return Ducts exposed to outdoors to be internally lined except ductwork conveying direct evaporatively cooled air.
  2. Supply and Return ductwork exposed to outdoors for direct evaporatively cooling systems to be externally insulated. Cover insulation with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- C. Supply and Return Ducts: Install lining on ductwork and plenums where shown or noted on drawings.

END OF SECTION 23 07 13

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 09 24  
DIRECT-DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. General

1. This Specification describes the minimum acceptable requirements for the design, engineering, fabrication, assembly, wiring, testing, installation, programming, and startup of the EMS. The DDCS contractor shall furnish and be responsible for all material, labor, and other services required to provide a fully operational Energy Management System (EMS), in accordance with this Specification.
2. The DDCS shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, standalone DDC panels, and operator devices.
3. All labor, material, equipment and software necessary to meet the functional intent of the EMS and Temperature Control systems as specified herein shall be included.
4. The Facility Management System shall be Johnson Controls Metasys "Network Automation Engine" and capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, and historical data collection and archiving via browser by the existing Johnson Controls "ADS" Application and Data Server. No other manufacturers or systems will be considered.  
NO SUBSTITUTION.

1.02 RELATED SECTIONS

- A. Division 23 Sections
- B. Division 26 - Electrical Work.

1.03 REFERENCES

- A. NEMA - National Electrical Manufacturer's Association.
- B. UL - Underwriter's Laboratories, Inc.
- C. NFPA - 70 National Electric Code (NEC).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

D. Title 24 California Code of Regulation (CCR) Title 24, Part 3, Basic Electrical Requirements, State Building Standards Electric Code.

1.04 QUALITY ASSURANCE

A. Design Criteria

1. All materials and equipment used shall be standard components, of regular manufacture for this application.
2. All systems and components shall have been thoroughly tested and proven in actual use.
3. All work described in this section shall be installed, wired, circuit tested and calibrated by factory-trained electricians and mechanics qualified for this work that are in the regular employ of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative).
  - a. Electrical Power Wiring and connections to motors and control equipment and panels shall be furnished and installed by the Electrical Contractor.
  - b. C.C.R. - Title 24 Energy Standards, Requirements: All work, controls devices and control operation and settings shall meet current requirements of the C.C.R. Energy Standards.
4. The contractor shall coordinate the location of all taps and wells in all hydronic piping for all sensors and flow measurement devices with the mechanical contractor.
5. Unacceptable Bids
  - a. Bids by wholesalers
  - b. Engineer reserves the right to reject, at his option, any and all bids that do not meet the specified requirements stated.
  - c. It is the contractor's responsibility to verify that the proposed control system meets or exceeds the requirements and intent of the contract documents. If the contractor proposes a system which does not meet these requirements the contractor shall pay the cost difference to modify the DDCS system to render it equal to specified.
  - d. A mechanical contractor and its related service company will not be considered as a qualified temperature control contractor.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Guarantee: Entire system shall be guaranteed for one year from date of acceptance of the completed building. Form of Guarantee subject to Architect's approval.

1.05 SUBMITTALS

- A. Shop drawings, product data and Service contract.
  - 1. Controls service contract including description of training be provided to owner.
  - 2. Material list and description.
- B. Prior to installation, the contractor shall submit wiring and control diagrams, component data and description of sequences of operation for approval.
- C. Supply all equipment and accessories in accordance with the requirements of all applicable national, state and local codes.
- D. All items of a given type shall be the products of the same manufacturer.
- E. Bidder shall present the names of five comparable projects, within Northern California, which have been successfully completed, and are in full operation.
- F. Temperature control contractor shall have a service office that is staffed with factory-authorized service technicians capable of servicing all aspects of the control system. This office shall have 24-hour emergency service and shall provide a maximum four-hour trouble response guarantee.
- G. The required number of copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's catalog cuts, and installation instructions.
  - 1. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.
  - 2. A complete written description of operation shall also be included with the submittal package.
- H. Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished and include the following for the BMS provided:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Table of contents.
  2. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  3. Manufacturer's product data sheets or catalog pages for all products including software.
  4. System Operator's manuals.
  5. Archive copy of all site-specific databases and sequences.
  6. BMS network diagrams.
  7. Interfaces to all third-party products and work by other trades.
  8. All necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.
  9. After completion of all tests and adjustments the contractor shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server.
- I. Equipment and labor not specifically referred to herein or on the plans, that is required to meet the functional intent, shall be provided without additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Management System shall consist of the following:
1. Standalone Network Controller(s)
  2. Field Equipment Controller(s)

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

3. Input/Output Module(s)
  4. Local Display Device(s)
  5. Distributed User Interface(s)
  6. Network processing, data storage and communications equipment
  7. Other components required for a complete and working BMS
- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
  2. The System shall maintain all settings and overrides through a system reboot.
- E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
1. The System shall comply with the International Code Council (ICC) Codes:
  2. Acceptable Manufacturers
    - a. Johnson Controls, Inc., Metasys.

## 2.02 BMS ARCHITECTURE

### A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
3. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.

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4. Network controllers shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network

1. Network controllers shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
  - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
    - 1) The controller shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
    - 2) The controller shall be tested and certified as a BACnet Building Controller (B-BC).
  - b. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
  - c. The Johnson Controls N2 Field Bus.
2. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

C. Integration

1. Hardwired
  - a. Analog and digital signal values shall be passed from one system to another via hardwired connections.



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- b. There will be one separate physical point on each system for each point to be integrated between the systems.

2. Direct Protocol (Integrator Panel)

- a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels. The BMS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
- b. All data required by the application shall be mapped into the Automation Engine's database, and shall be transparent to the operator.
- c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.

3. BACnet Protocol Integration - BACnet

- a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2008.
- b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
- c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.03 USER INTERFACE

A. Dedicated Web Based User Interface

- 1. BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.

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4 JANUARY 2024

2. Dedicated User Interface Architecture - The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
  - a. Microsoft Internet Explorer for user interface functions
  - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
  - c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
  - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries
  
3. PC Hardware - The personal computer(s) shall be configured as follows:
  - a. Memory - 1 GB (512 MB Minimum)
  - b. CPU- Pentium 4 processor. 2.8 GHz Clock Speed (2.0 GHz minimum)
  - c. Hard Drive - 80 GB free hard drive space (40GB minimum)
  - d. Hard drive backup system - CD/RW, DVD/RW or network backup software provided by IT department
  - e. CD ROM Drive - 32X performance
  - f. Ports - (2) Serial and (1) parallel, (2) USB ports
  - g. Keyboard - 101 Keyboard and 2 Button Mouse
  - h. CRT configuration - 1-2 CRTs as follows:
    - 1) Each Display - 17" Flat Panel Monitor 1280 x 1024 resolution minimum
    - 2) 16 bit or higher color resolution
    - 3) Display card with multiple monitor support

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

- i. LAN communications - Ethernet communications board; 3Comm or equal
4. Operating System Software
- a. Windows XP Professional or Windows 7 (64 bit)
  - b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
  - c. Provide software registration cards to the Owner for all included software.
- B. Distributed Web Based User Interface
1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
  2. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser supporting the following functions:
    - a. Configuration
    - b. Commissioning
    - c. Data Archiving
    - d. Monitoring
    - e. Commanding
    - f. System Diagnostics
  3. Minimum hardware requirements:
    - a. 1GB RAM
    - b. 2.0 GHz Clock Speed Pentium 4 Microprocessor
    - c. 100 GB Hard Drive.
    - d. 1 Keyboard with 83 keys (minimum).

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

- e. SVGA 1024x768 resolution display with 64K colors and 16 bit color depth
- f. Mouse or other pointing device

C. Site Management User Interface Application Components

1. Operator Interface

- a. An integrated browser based client application shall be used as the user operator interface program.
- b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
- c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
- d. The user interface software shall provide help menus and instructions for each operation and/or application.
- e. The system shall support customization of the UI configuration and a home page display for each operator.
- f. The system shall support user preferences in the following screen presentations:
  - 1) Alarm
  - 2) Trend
  - 3) Display
  - 4) Applications
- g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
- h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
  - 1) User access for selective information retrieval and control command execution

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

- 2) Monitoring and reporting
  - 3) Alarm, non-normal, and return to normal condition annunciation
  - 4) Selective operator override and other control actions
  - 5) Information archiving, manipulation, formatting, display and reporting
  - 6) BMS internal performance supervision and diagnostics
  - 7) On-line access to user HELP menus
  - 8) On-line access to current BMS as-built records and documentation
  - 9) Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications
- i. The system shall support a list of application programs configured by the users that are called up by the following means:
    - 1) The Tools Menu
    - 2) Hyperlinks within the graphics displays
    - 3) Key sequences
  - j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.
2. Navigation Trees
    - a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
3. Alarms

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

- a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers.

4. Reports and Summaries

- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
  - 1) All points in the BMS
  - 2) All points in each BMS application
  - 3) All points in a specific controller
  - 4) All points in a user-defined group of points
  - 5) All points currently in alarm
  - 6) All points locked out
  - 7) All user defined and adjustable variables, schedules, interlocks and the like.
- b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.

5. Schedules

- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
  - 1) Weekly schedules
  - 2) Exception Schedules
  - 3) Monthly calendars

6. Security/Passwords

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4 JANUARY 2024

- a. Multiple-level passwords access protection shall be provided via roles and permissions. The feature will allow the system to base access on a user's job title or role and allow the user/manager access interface control, display, and database manipulation capabilities based on an assigned password.

7. Screen Manager

- a. The system will allow a customized image on the login screen (i.e. organization name, logo).

8. Dynamic Color Graphics

- a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.

9. Historical trending and data collection

- a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
  - 1) Any point, physical or calculated, may be designated for trending. Two methods of collection shall be allowed:
    - 2) Defined time interval
    - 3) Upon a change of value
  - 4) Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
- b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.
- c. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in SQL database format.

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

- d. The system shall provide data to enable optimization capabilities including fault detection and diagnostics, advanced analytics and central plant optimization without the need of a gateway or additional hardware.

10. Trend data viewing and analysis

- a. Provide a trend viewing utility that shall have access to all database points.
- b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
- c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
- d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
- e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
- f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.

11. Database Management

- a. Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
- b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.



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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

2.04 WIRES, CABLES AND TERMINATIONS

- A. Control Wiring and Conduit for the control equipment in accordance with the submitted wiring diagrams, and the functional operation of the control system shall be the responsibility of the control contractor. All control wiring shall be installed in accordance with local codes and the C.E.C. All control wiring shall be in conduit, concealed in walls or slab or above a non-removable ceiling, and on roof. Control wiring is not required to be in conduit above removable ceilings. Line voltage control wiring and low voltage control wiring shall be Type THHN/THWN wire per C.E.C. Low-voltage jacketed multi-conductor cable may be used for thermostat wiring installed in conduit.
- B. Rigid Steel Conduit
  - 1. Standard weight, mild steel pipe, heavy wall, with threaded fittings, zinc coated on both inside and outside by a hot dipping or sherardizing process. Conduit fittings finished to same requirements as for rigid steel conduit. All couplings, unions and fittings threaded type. Rigid Conduit is required when exposed below 8' and all exterior and underground applications and sealed water tight.
- C. Electric Metallic Tubing (EMT)
  - 1. Shall be galvanized steel, thin wall. Maximum trade size used shall be 4 inches. May be used concealed in dry wall partitions, above furred ceiling, and for surface installation in mechanical equipment rooms or where exposed runs are specifically noted on drawings. May not be used underground, under floor, exposed to weather, in concrete, or in any location subject to physical damage.
  - 2. Connectors shall be steel rain tight compression type with insulated throat. Couplings shall be steel rain tight compression type. Set screw type fittings shall not be used.
- D. Flexible Metal Conduit

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

1. Shall be galvanized steel or aluminum with minimum trade size of 3/8" as permitted by CEC. In wet and corrosive locations or outside shall be liquid-tight, minimum size 1/2". May be used to connect recessed lighting fixtures to junction box or mechanical controls and equipment. May not be used in walls or furred ceilings except as expressly permitted by the Engineer and only where certain structural constraints allow no other means of routing. Length shall be kept to a minimum but shall allow for movement or removal of equipment. Leave slack in flex connection to maintain flexibility of conduit.
2. Connectors shall be tite-bit type with insulated throat, T&B Series 3110; connectors for liquid-tight shall be with insulated throat T&B Series 5331 with sealing "O"-ring at outside of enclosure.

2.05 SENSORS AND INSTRUMENTATION

- A. All sensors, equipment and controls, e.g., switches, relays, etc., shall be clearly identified and labeled as to function and position.

2.06 CONTROL PANELS

- A. Control Panels shall be code gauge steel, electric cabinet to house pre-wired controls. Doors with hardware shall be furnished to provide access to control devices. Wiring shall be brought to terminal strips. The panel front shall contain pilot lights, switches, lucite plot plan, and thermometers as required. Provide California "Dead Front". All steel members shall be prime coated and the outside surfaces shall have two additional coats baked enamel; color as selected. Furnish detailed drawings for approval.
- B. Furnish Temperature Control Panels with a locking door for mounting all devices as shown. They shall meet all applicable requirements of Title 24, California Administrative Code.
- C. All controllers, relays, switches, etc. for equipment located in mechanical equipment rooms shall be mounted in a TCP. Temperature settings, adjustments and calibration shall done at the TCP. All electric devices within a control panel shall be factory wired.
- D. Provide engraved laminated plastic nameplates identifying all devices mounted on the face of the control panels. A complete set of related "as-built" control drawings shall be furnished in each control panel.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.07 NETWORK CONTROLLER

- A. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
- B. Automation network - The NAE shall reside on the automation network and shall support a subnet of system controllers.
- C. User Interface - Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
- D. Processor - The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
- E. Memory - Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
- F. Hardware Real Time Clock - The NAE shall include an integrated, hardware-Based, real-time clock.
- G. The NAE shall include troubleshooting LED indicators.
- H. Communications Ports - The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
  - 1. USB port
  - 2. URS-232 serial data communication port
  - 3. RS-485 port
  - 4. Ethernet port
- I. Diagnostics - The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- J. Power Failure - In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
- K. Certification - The NAE shall be listed by Underwriters Laboratories (UL).
- L. Controller network - The NAE shall support the following communication protocols on the controller network:
  - 1. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
  - 2. The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.
  - 3. The NAE shall support the Johnson Controls N2 Field Bus.
- M. Communications Ports - The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
  - 1. Two (2) USB port
  - 2. Two (2) URS-232 serial data communication port
  - 3. Two (2) RS-485 port
  - 4. One (1) Ethernet port
- N. Controller network - The NAE shall support the following communication protocols on the controller network:
  - 1. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
  - 2. The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.
- O. The NAE shall support the Johnson Controls N2 Field Bus.

2.08 FIELD CONTROLLER

- A. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
- C. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
- D. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
- E. The FEC shall include troubleshooting LED indicators.
- F. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
- G. The FEC shall support the following types of inputs and outputs:
  - 1. Universal Inputs.
  - 2. Binary Inputs.
  - 3. Analog Outputs.
  - 4. Binary Outputs.
  - 5. Configurable Outputs.
- H. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
- I. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
- J. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
- K. The FEC shall support a Local Controller Display (DIS-1710) either as an integral part of the FEC or as a remote device communicating over the SA Bus.

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4 JANUARY 2024

PART 3 - EXECUTION

3.01 GENERAL

- A. Furnish all fabrication, labor, materials, equipment, service, assembly, wiring, testing, installation, programming, software, and startup of the EMS engineering, necessary for a complete and operating temperature control and energy management system. This system shall meet the functional intent as specified herein for all equipment shown on the drawings.
- B. After completion of the installation, the control contractor shall regulate and adjust all thermostats, dampers, control valves, motors and other equipment provided under this contract.
- C. Provide assistance to TAB contractor and commissioning authority to operate the control system during TAB and calibration of control devices.
- D. Identify each item mounted on the face of a control panel with an engraved phenolic label ( $\frac{1}{4}$ " high engraved letters minimum). Identify each item of control equipment (except room sensors and thermostats) with stamped tape firmly attached to equipment.
- E. All control adjustments shall be accessible without use of a ladder.

3.02 RECORD DRAWINGS

- A. Upon completion of the work provide a detailed description of the operation of each component and post in the mechanical room framed under glass or covered in plastic. Additionally, provide a complete set of drawings and application software on magnetic floppy disk media. Drawings shall be as AutoCad compatible files.

3.03 WARRANTY AND SERVICE

- A. The control contractor shall provide a one year warranty from the date of installation acceptance, covering the temperature control system. Any manufacturing defects arising during this warranty period shall be corrected without cost to the owner. The contractor shall respond to the job site within a 4-hour period for any emergency relating to the control system.

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

3.04 OPERATOR INSTRUCTION

- A. At such time acceptable performance of the EMS hardware and software has been established, the control contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent representative familiar with the systems hardware, software and accessories.
- B. At a time mutually agreed upon, the controls contractor shall give 16 hours of instruction to the owner's designated personnel on the operation of the EMS and temperature control systems and describe its intended use with respect to the programmed functions specified. Operator orientation of the EMS shall include, but not limited to, the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in one session as follows
  - 1. Initial Training
    - a. One day, after system is started up, and at least one week before first acceptance test. The O&M's shall have been submitted at least two weeks prior to training so that the owner's personnel can start to familiarize themselves with the system before classroom instruction.
  - 2. Warranty Follow-up
    - a. 4 hours, to be scheduled at the request of the owner during the warranty period. These sessions shall cover topics as requested by the owner, including how to install additional points and add additional controllers.

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SACRAMENTO, CALIFORNIA  
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4 JANUARY 2024

SECTION 23 31 00  
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Air plenums and casings.
- C. Ducts for kitchen exhaust applications.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 230713 - Duct Insulation.
- C. Section 23 33 00 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 126 - Method of Testing HVAC Air Ducts 2020.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2023.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- F. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2023a.
- G. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems 2020.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2024.
- J. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids 2020.
- K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2020.
- L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.
- M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.
- N. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors Current Edition, Including All Revisions.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.
- P. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- Q. UL 1978 - Grease Ducts Current Edition, Including All Revisions.
- R. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies Current Edition, Including All Revisions.

1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data for duct materials.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all ductwork systems. Provide 1/4"=1'-0" ductwork layout plans showing duct routing, offsets, fittings, duct accessories, fire/smoke dampers, hydronic piping, seismic bracing, etc. Shop drawings shall be fully coordinated with all other trades, including the building structure, finishes, fire sprinkler piping, plumbing piping, hydronic piping and electrical systems.
- D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.07 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.
- B. Duct Sealing and Leakage in accordance with Static Pressure Class:
  - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
    - a. Supply Air: 2 in-wc pressure class, galvanized steel.
    - b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.
    - c. Return and Relief Air: 1 in-wc 2 in-wc pressure class, galvanized steel.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
  2. Low Pressure Service: Up to 2 in-wc:
    - a. Seal: Class C, apply to seal off transverse joints.
  3. Low Pressure Service: From 2 in-wc to 3 in-wc:
    - a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
  4. Medium and High Pressure Service: Above 3 in-wc:
    - a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
- C. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
  2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
  3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
  4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
  5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
  6. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
  7. Exposed ductwork within occupied spaces shall be 20 gauge minimum.

## 2.02 METAL DUCTS

### A. Material Requirements:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
  2. Stainless Steel: ASTM A666, Type 304.
    - a. Application: Kitchen exhaust.
- B. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.
  2. Manufacturers:
    - a. EHG, a DMI Company: [www.ehgduct.com/#sle](http://www.ehgduct.com/#sle).
    - b. Elgen Manufacturing Company, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
    - c. Linx Industries, Inc, a DMI Company: [www.li-hvac.com/#sle](http://www.li-hvac.com/#sle).
    - d. MKT Metal Manufacturing: [www.mktduct.com/#sle](http://www.mktduct.com/#sle).
- C. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
  2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
    - a. Manufacturers:
      - 1) Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
      - 2) Ductmate Industries, Inc, a DMI Company : [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
      - 3) Elgen Manufacturing Company, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
    - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
    - b. VOC Content: Not more than 250 g/L, excluding water.
    - c. Sealants intended for use outdoors to include UV inhibitors.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
- e. Manufacturers:
  - 1) Carlisle HVAC Products; Hardcast Duct-Seal 321 Indoor/Outdoor Water Based Duct Sealant: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
  - 2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
  - 3) Ductmate Industries, Inc, a DMI Company  
: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).

4. Gasket Tape:

- a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
- b. Manufacturers:
  - 1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket Tape: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
  - 2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket Tape: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).

2.03 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

- A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.
- B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.
- C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.
- D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.
- E. Kitchen Hood and Grease Exhaust Duct:
  - 1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Round, Single-Wall, Premanufactured Grease Exhaust Duct:
  - a. UL Listed and labeled to UL 1978.
  - b. Construct of 20-gauge, 0.035-inch Type 304 stainless steel.
3. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
  - a. UL Listed and labeled to UL 1978.
  - b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.
4. Zero Clearance, 2-Hour Fire-Rated, Round, Double-Wall, Premanufactured Grease Duct:
  - a. UL Listed and labeled to UL 1978 and UL 2221.
  - b. Nominal 3 inches thick, high density body soluble fiber insulation between 20-gauge, 0.035-inch Type 304 stainless steel liner, and 24-gauge, 0.0239-inch aluminized steel sheet outer jacket.
  - c. Seal joints during installation with factory-supplied overlapping V-bands and sealant.
  - d. Through-penetration firestop listed to UL 1479 or ASTM E814.
  - e. Minimum horizontal slope of 1/4 inch per foot per manufacturers listing to UL 1978.
5. Zero Clearance, 2-Hour Fire-Rated, Rectangular, Double-Wall, Premanufactured Grease Duct:
  - a. Listed when tested in accordance with UL 1978 and ASTM E2336.
  - b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.
  - c. Liquidtight with continuous external weld for seams and joints.
  - d. Through-penetration firestop listed to UL 1479 or ASTM E814.
  - e. Listed when tested in accordance with UL 1978.
  - f. Install hinged access doors where indicated or required for access for cleaning and inspection of duct.
6. Grease Exhaust Duct Access Doors:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Ductwork exposed to view outdoors shall be primed and painted, color by architect.
- G. Duct sizes indicated are outside dimensions. For lined ducts, duct sizes must be increased to account for lining.
- H. Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast DT tape, 4 inches wide, and Hardcast FTA-20 adhesive.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Use double nuts and lock washers on threaded rod supports.
- K. Use stainless steel for ductwork exposed to view in Kitchen areas.
- L. Kitchen hood exhaust ductwork shall so be constructed and installed that grease cannot be pocketed in any portion thereof, and the system shall slope not less than 1/4 unit vertical in 12 units horizontal (2% slope) toward the hood or toward an approved grease reservoir.
- M. Kitchen hood exhaust ductwork shall be wrapped with a 2 hour fire resistive duct wrap designed for use specifically with kitchen grease ducts, installed in accordance with manufacturer's installation instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- N. Grease ductwork systems shall be leakage tested per CMC 510.5.3.1 and CMC 510.5.6. Perform light test: A light of no less than 100 watts is passed through the entire duct system, including the hood-to-duct connection. If any light shines through any portion of the ductwork in a darkened room, the hole must be found and welded so that the light is no longer visible.

END OF SECTION 23 31 00



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 33 00  
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices.
- B. Duct access doors.
- C. Duct test holes.
- D. Flexible duct connectors.
- E. Volume control dampers.
- F. Miscellaneous Products:
  - 1. Damper operators.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2020.
- E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2020.
- F. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.
- G. UL 1978 - Grease Ducts Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.
- D. Section 013300 - Submittals.

1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

1.06 PROJECT RECORD DOCUMENTS

- A. Record actual locations of access doors and test holes.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES

- A. Manufacturers:
  - 1. ProRail, Ductmate Industries, Inc.
  - 2. Duro Dyne Corp.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Manufactured turning vanes with 2" single thickness curved blades set at 1-1/2" on-center mounted in 2" vane rails, self-aligning, hot dipped galvanized steel.
- C. Turning vanes, vane rails and mounting shall be constructed and installed in accordance with the SMACNA "HVAC Duct Construction Standards".

2.02 DUCT ACCESS DOORS

A. Manufacturers:

- 1. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
- 2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- 3. or equal.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.

- 1. High Temperature Duct Access Doors:
  - a. Comply with NFPA 96.
  - b. Comply with UL 1978.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.03 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.04 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:

- 1. Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
- 2. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections (Indoors): Fabric crimped into metal edging strip.

- 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
  - a. Net Fabric Width: Approximately 2 inches wide.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- D. Flexible Duct Connections (Outdoors): Fabric crimped into metal edging strip.
1. Fabric: Ventfabrics Ventlon UL listed fire-retardant duPont's Hypalon coated woven glass fiber fabric to NFPA 90A, minimum density 26 oz per sq yd, sunlight, ozone and weather resistant.
    - a. Net Fabric Width: Approximately 3 inches wide.
  2. Metal: 3 inches wide, 24 gage thick galvanized steel.

2.05 VOLUME CONTROL DAMPERS

- A. Manufacturers:
1. Nailor Industries, Inc: [www.nailor.com/#sle](http://www.nailor.com/#sle).
  2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  3. United Enertech: [www.unitedenertech.com/#sle](http://www.unitedenertech.com/#sle).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers for Round Ductwork and Rectangular Ductwork up to 10 inches in Height: 18 gauge steel minimum.
- D. Multi-Blade Damper for Rectangular Ductwork: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Model CD35 Manufactured by Ruskin. Provide Ruskin Model CD50 for installation in medium pressure ductwork and/or ducts with velocities exceeding 1500 FPM.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings, Ventlok Model 607. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.
- F. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  3. Where rod lengths exceed 30 inches provide regulator at both ends.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.06 MISCELLANEOUS PRODUCTS

- A. Remote Balancing Damper Operator: Cable operated remote damper controller.
  - 1. Manufacturers:
    - a. Young Regulator Co.; [www.youngregulator.com](http://www.youngregulator.com)
  - 2. "Bowden" damper regulator with mounting bracket, hub and cable coupling.
  - 3. "Bowden" stainless steel operating cable and control wrench. Cable to be 50 foot length standard.
  - 4. Recessed control box with control shaft, cable coupling and cover plate.
  - 5. Provide options and accessories as needed for balancing damper.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Coordinate fire/smoke damper requirements with Division 26 and Division 28.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 14 by 14 inch size access door for hand and shoulder access, or as indicated on drawings.
- D. For concealed balancing dampers only where damper is inaccessible, provide Young Regulator "Bowden" cable operated damper controller.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.
- F. Provide balancing dampers at points on supply, return, outside air and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 34 23  
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Kitchen hood upblast roof exhausters.

1.02 RELATED REQUIREMENTS

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016, with Errata (2018).
- E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance 2022, with Editorial Revision (2023).
- F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating 2020.
- G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2022.
- I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance 2016.
- J. ANSI Z9.5 - Laboratory Ventilation 2022.
- K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- L. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids 2020.
- M. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2020.
- N. UL 705 - Power Ventilators Current Edition, Including All Revisions.
- O. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances Current Edition, Including All Revisions.

1.04 RELATED SECTIONS

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.
- D. Section 013300 - Submittals.

1.05 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Protect units from physical damage by storing indoors or off site until roof mounting curbs or other mountings are in place, ready for immediate installation of units.

1.08 WARRANTY

- A. See Section 01700 - Contract Closeout, for additional warranty requirements.
- B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
- B. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).
- C. CaptiveAire

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.03 ROOF EXHAUSTERS

- A. Product Requirements:
  - 1. Performance Ratings: Conform to AMCA 210 and bearing the AMCA Certified Rating Seal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
  3. Fabrication: Conform to AMCA 99.
  4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof exhaust fans fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.
- D. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.
- E. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.
- F. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.
- G. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
- H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- I. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, and insulation.
- J. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- K. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- L. See drawing schedule for additional optional equipment requirements.

2.04 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:

1. Fan Wheel:

- a. Type: Non-overloading, backward inclined centrifugal.
- b. Material: Aluminum, statically and dynamically balanced.

2. Statically and dynamically balanced.

3. Motors:

- a. Open drip-proof (ODP).
- b. Heavy duty ball bearing type.
- c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
- d. Fully accessible for maintenance.

4. Housing:

- a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
- b. Rigid internal support structure.
- c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
- d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
- e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:

1. Fan Shaft:

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Ground and polished steel with anti-corrosive coating.
  - b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
- a. Permanently sealed or pillow block type.
  - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
  - c. 100 percent factory tested.
- C. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
  2. Belts: Static free and oil resistant.
  3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
  4. Motor pulley adjustable for final system balancing.
  5. Readily accessible for maintenance.
- D. Disconnect Switches:
1. Factory mounted and wired.
  2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  3. Positive electrical shutoff.
  4. Wired from fan motor to junction box installed within motor compartment.
- E. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip.
- F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.
- G. Options/Accessories:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.
2. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
3. Grease Trap:
  - a. Aluminum.
  - b. Built-in drain connection.
  - c. Container system to collect grease residue.
4. Hinge Kit:
  - a. Aluminum hinges.
  - b. Hinges and restraint cables mounted to base sleeve.
  - c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
5. Heat Baffle: Prevents heat from radiating into motor compartment.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with stainless steel lag screws to roof curb. See drawings for additional mounting requirements.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Provide sheaves required for final air balance.
- E. Provide speed control on direct drive fans required for final air balance.
- F. Install backdraft dampers on inlet to roof exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans and as indicated.

END OF SECTION 23 34 23

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 74 13

PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged Heat Pump Unit.

1.02 RELATED REQUIREMENTS

- A. Division 26: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment 2015, with Addendum (2016).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- D. Unit shall be designed to conform to ASHRAE 15, latest revision, and in accordance with UL 1995.
- E. Units shall be UL tested and certified in accordance with ANSI Z21.47 Standard. Units may be ETL listed.
- F. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

1.04 SUBMITTALS

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.07 WARRANTY

- A. Provide a one year warranty to include coverage for refrigeration compressors.
- B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- C. Provide five year limited warranty for heat exchanger including materials only.
- D. Furnish one complete set of fan motor drive belts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Air Conditioning Units
  - 1. Bard
  - 2. or equal.

2.02 PACKAGED HEAT PUMP UNITS

- A. General
  - 1. Outdoor, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and heat pump for heating duty.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Factory assembled, single piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
  3. Unit shall use R-410a refrigerant.
  4. Unit shall be installed in accordance with the manufacturer's instructions.
  5. Unit must be selected and installed in compliance with local, state, and federal codes.
  6. Unit shall meet ASHRAE 90.1 and IECC minimum efficiency requirements.
  7. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
  8. Unit shall be designed to conform to ASHRAE 15.
  9. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL or ETL-listed and certified under Canadian standards as a total package for safety requirements.
  10. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
  11. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
  12. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
  13. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
  14. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
- B. Delivery, Storage, and Handling:
1. Unit shall be stored and handled per manufacturer's recommendations.
  2. Unit shall only be stored or positioned in the upright position.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Operating Characteristics:

1. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at  $\pm 10\%$  voltage.
2. Compressor with standard controls shall be capable of operation down to 30°F (−1°C), ambient outdoor temperatures. Accessory Low Ambient controls are available if mechanically cooling at ambient temperatures below 30°F (−1°C).
3. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.

D. Unit Cabinet:

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
2. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
3. Unit internal insulation linings shall be resistant to mold growth in accordance with “mold growth and humidity” test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the “Erosion Test” in UL 181, as part of ASTM C1071.
4. Condensate Pan and Connections:
  - a. Shall be a sloped condensate drain pan made of a non-corrosive material.
  - b. Shall comply with ASHRAE Standard 62.
5. Electrical Connections:
  - a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
6. Component Access Panels (standard):

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Cabinet panels shall be easily removable for servicing.

E. Coils:

1. Standard Aluminum Fin/Copper Tube Coils:

- a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.

F. Refrigerant components:

1. Refrigerant circuit shall include the following control, safety, and maintenance features:

- a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.

- 1) Refrigerant filter drier on each refrigerant circuit.
- 2) Service gauge connections on suction and discharge lines.
- 3) Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching. Standard on each refrigerant circuit.

2. Compressors:

- a. Unit shall use fully hermetic, scroll compressors.
  - 1) Compressor motors shall be cooled by refrigerant gas passing through motor windings.
  - 2) Compressors shall be internally protected from high discharge temperature conditions.
  - 3) Compressors shall be protected from an overtemperature and over-ampere conditions by an internal, motor overload device.
  - 4) Compressor shall be factory mounted on rubber grommets.
  - 5) Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 6) Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.

G. Filter section:

1. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
2. Filters shall be standard, commercially available sizes.

H. Evaporator fan and motor:

1. Evaporator fan motor:
  - a. Shall have permanently lubricated bearings.
    - 1) Shall have inherent automatic-reset thermal overload protection or circuit breaker.
    - 2) Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
2. Evaporator fan:
  - a. Blower fan shall be double inlet type with forward curved blades.
    - 1) Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

I. Condenser Fans and Motors:

1. Condenser fan motors:
  - a. Shall be a totally enclosed motor.
    - 1) Shall use permanently lubricated bearings.
    - 2) Shall have inherent thermal overload protection with an automatic reset feature.
2. Condenser fans:
  - a. Shall be a direct driven propeller type fan and shall be dynamically balanced.

J. Special features, options, and accessories:

1. Head pressure control package:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Controller shall control coil head pressure by condenser fan speed modulation or condenser fan cycling and wind baffles.
  - b. Shall consist of solid state control and condenser coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to -20°F (-29°C).
2. Anti-short Cycle Timer:
- a. Shall prevent compressor short cycling by providing a 5-minute delay ( $\pm 2$  minutes) before restarting a compressor after shutdown for any reason.
  - b. One device shall be required per compressor.
3. Electric Heat:
- a. Heating Section:
    - 1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
    - 2) Heater assemblies are provided with integral fusing in the single point box (if applicable) for protection of internal heater circuits not exceeding 48 amps each. Electric heaters use a combination of 24v control side break/auto-reset, line-break/non-resettable "one shot" limit switches to protect the unit against over-temperature situations. All heaters use magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 90A.

END OF SECTION 23 74 13

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 23 74 33  
DEDICATED OUTDOOR AIR UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted DOAS.

1.02 RELATED REQUIREMENTS

- A. Section 23 09 24 - Direct-Digital Control System for HVAC.
- B. Section 23 33 00 - Air Duct Accessories: Flexible duct connections.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment 2015, with Addendum (2016).
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units 2022.
- E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2024.
- H. UL (DIR) - Online Certifications Directory Current Edition.
- I. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- C. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturers warranty for compressor/condenser unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. CaptiveAire Systems: [www.captiveaire.com/#sle](http://www.captiveaire.com/#sle).

2.02 ROOF-MOUNTED DOAS

- A. Packaged Unit:

1. Casing and Components:

- a. Fabrication: AHRI 210/240 and UL 207 construction, ASHRAE Std 23 tested.
- b. 18 gauge, 0.0478 inch steel panels reinforced with structural angles and channels to ensure rigidity.
- c. Provide bolted access panels to access each sections from either side of unit.
- d. Provide hinged door with lockable handle for serviceable sections.
- e. Drain Pan: Galvanized steel with corrosion-resistant coating.

2. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.

3. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
  5. External Surface Finish: Heat resistant baked enamel.
  6. Outdoor Installation: Weatherproofed casing, with intake louver or hood.
  7. Outside Air Damper with Rain Hood and Screen:
    - a. Set motorized outdoor air damper(s) to factory-identified preset position to provide up to 30 percent outside air when fan starts and close 30 seconds after fan stops, adjustable.
- B. Filter Section:
1. Filter: Removable, 4 inches thick MERV-13.
- C. Heating Section:
1. Indirect Gas-Fired Furnace:
    - a. Fully sealed natural gas burning assembly configured for modulated 25:1 turn down ratio using electrically operated devices including modulating main gas valve, shut down valve, main gas, and pilot gas regulators. Manual main gas shut-off valve and pilot adjustment valve.
    - b. Insulation: Neoprene faced glass fiber insulation, 1 inch thick, on inlet components to burner profile plate.
    - c. Observation Port: On burner section for observing main and pilot flames.
    - d. Pilot: Electrically ignited by spark rod through high voltage ignition transformer.
    - e. Damper: Motorized with end switch to prove position before burner will fire.
- D. Cooling Section:
1. Packaged DX Cooling:
    - a. Configuration: AHRI 520 rated, R-410a refrigerant system with hot gas bypass.
    - b. Evaporator Coil: Copper tube aluminum fin coil assembly with alternate row circuiting, and with galvanized drain pan and thermostatic expansion valve.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Compressor: Inverter-duty hermetic single-stage scroll, 3,600 rpm maximum resilience with positive lubrication, crankcase heater, high pressure control, low pressure control, motor overload protection, service valves and dryer.
- d. Condenser Side: Aluminum fin and copper tube coil, direct drive axial fan resiliently mounted, galvanized fan guard. ECM condenser fans.
- e. Operating and Safety Controls: Internally coordinated with main unit controls.

E. Fan Section:

- 1. Provide direct or plenum mounted variable-speed fan motors; see Section 23 05 13.
  - 2. Draw-through, forward-curved fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.
  - 3. Factory program for both soft start and constant flow output over static pressure range.
  - 4. Provide preinstalled neutral wire protection when required to support specified fan type.
  - 5. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.
  - 6. Belt-Driven Motor Requirements: Provide adjustable blower motor/sheave combination device based on indicated flow performance requirements. Statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy-duty, self-aligning, prelubricated ball bearings and V-belt drive with matching motor sheaves and belts.
  - 7. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units; see Section 23 09 34.
  - 8. Fan Turndown: Design control features to allow fan speed reduction to adjustable 50 percent of its capacity when the zone set point temperature is satisfied or when unit runs in fan-only mode.
- F. Furnish dedicated outdoor air unit and associated components and accessories produced by a single manufacturer.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install unit on vibration isolator pad or roof curb; see Section 23 05 48.
- C. Provide flexible duct connections on inlet and outlet from unit; see Section 23 33 00.
- D. Connect drain pan outlet to nearest building drain system piping.

END OF SECTION 23 74 33

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 00  
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 CONTRACT PROVISIONS

- A. The requirements of this Section are in addition to the requirements of Division 1, General Conditions and Supplementary Conditions.

1.02 SUMMARY

- A. This section describes the requirements for the electrical work includes, among others, the furnishing and installation of the following:
  - 1. Electrical service from the Main Switchboard to the building Distribution Panel(s) including transformer(s), conduit and trenching, conductors.
  - 2. Power distribution system.
  - 3. Grounding system.
  - 4. Lighting and lighting control systems.
  - 5. Wiring systems including power wiring to plumbing and HVAC and other misc. appliances and equipment.
  - 6. Electrical services (power) for Communications management system. (voice/video/media/clock) as described in Division 27 and as indicated on the drawings.
  - 7. Electrical services (power) for Computer data systems, as described in Division 28 and as indicated on the drawings to include outlets, raceways, and cabling.
  - 8. Electrical services (power) for Intrusion alarm and security systems as described in Division 28 and as indicated on the drawings.
  - 9. Emergency egress lighting.
  - 10. Testing and commissioning for all electrical work installed under this contract and as described in these specifications and indicated on the drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Furnish and install all electrical equipment and systems as shown on the Drawings and as described in this Division of the Specifications to provide a complete and functional electrical installation. This work includes but is not limited to all material and labor required for installation of electrical and special systems complete as described herein this specification and drawings; and connections (and installation where not otherwise provided for) of electrical equipment furnished by others. Provide and install all items of equipment, devices, supports, etc., which are incidental to the major components shown on the Drawings or described in these Specifications.

1.03 DEFINITIONS

- A. The meaning of words shall be as defined in the CEC Article 100, Definitions, unless defined otherwise in an individual specification section.
- B. The following specification development organizations are referenced throughout the various specification sections of Division 26:
  - 1. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
  - 2. Air Pollution Control District, Air Quality Management District.
  - 3. ANSI – American National Standards Institute.
  - 4. AQMD – Air Quality Management District.
  - 5. ASME – American Society of Mechanical Engineers.
  - 6. ASTM – American Society for Testing and Materials.
  - 7. CBC – California Building Code.
  - 8. 10. CCR – California Code of Regulations Title 24 State Chapters.
  - 9. 11. CEC – California Electrical Code.
  - 10. 12. CFC – California Fire Code.
  - 11. 13. CMC – California Mechanical Code.
  - 12. 15. EIA – Electronic Industries Association.
  - 13. 16. FCC – Federal Communications Commission.
  - 14. 19. ICEA – Insulated Cable Engineers Association.
  - 15. 20. IEC – International Electromechanical Commission.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

16. 21. IEEE – Institute of Electrical and Electronic Engineers.
17. 24. ISO – International Organization for Standardization.
18. 27. NECA – National Electrical Contractors Association.
19. 28. NEMA – National Electrical Manufacturing Association.
20. 29. NETA – National Electrical Testing Association.
21. 30. NFPA – National Fire Protection Association.
22. 32. OSHA – Occupational Safety and Health Administration.
23. 34. UL – Underwriters Laboratories.

1.04 RELATED WORK INCLUDED IN OTHER DIVISIONS

- A. Finish painting except factory applied finishes and repair of factory finishes shall be provided in accordance with appropriate sections of this Specification. Coordinate "painting" requirements of this Division with other trades as required to assure timely and satisfactory completion of required work. In finished areas, all exposed raceway, boxes, galvanized steel box covers (where allowed), and other electrical "structure" shall be finished to match adjacent structures. Verify that all raceway openings are closed and box covers are in place prior to finishing work done by others.
- B. Examine the drawings and specification for mechanical and plumbing equipment and provide electrical installation for heating, ventilation and air conditioning equipment, motors, pumps and associated motor starters and controls as described in Division 22 and Division 23.
- C. Examine the Architectural drawings and specification for electrical appliances and equipment which may not be shown on the plans to include and provide electrical installations as described in the architectural division of work.
- D. Examine the Architectural drawings and provide all construction necessary to maintain the integrity of the fire rated barriers.
- E. Examine the Architectural drawings and coordinate with the Architect to provide access doors, whether shown on drawings or not, where floors, walls, or ceiling must be penetrated for access to electrical equipment, outlet boxes, devices, etc., and as specified in this specification.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Provide and install, as part of the work described in this Division, all power and control wiring fed from a source of 30 Volts or more (i.e. all wiring except temperature control wiring) for mechanical equipment described in Division 23.
- G. Examine the fire sprinkler system drawings and specifications for electrical work which may not be shown on the electrical and/or fire detection and alarm plans to be included in the electrical work as necessary as described in the Division 21 fire sprinkler system.

1.05 APPLICATION OF OTHER DIVISIONS

- A. Where carpentry, masonry, concrete work, painting, etc., is required in the installation of equipment specified under this Division, the work shall be done in accordance with the applicable Division of these Specifications. This work could include for example: work associated with panelboard installation, equipment pads or bases, support structures, etc.

1.06 DRAWINGS AND SPECIFICATIONS

- A. The information presented in these Specifications, and on the drawings, is intended to describe the utilitarian and physical aspects of the systems shown as well as the quality of the entire installation. All information is as complete and thorough as possible, but every condition or situation cannot be anticipated. Exact locations, dimensions, elevations, etc. must be determined "on the job" with careful attention to the "intent" of the Drawings and Specifications.
- B. The above paragraph shall not be construed as to allow significant deviation from either the Drawings or Specifications without prior approval of the Architect, but minor changes in conduit routing or equipment locations may be required or desired due to specific conditions encountered. This work shall be accomplished in accordance with these Specifications and no "extra charges" are to be created for any unanticipated labor or material.
- C. Any error or omissions of detail in either the drawings or the specifications shall not relieve the Contractor from correctly installing all materials necessary for complete and operating electrical systems.
- D. Contractor shall inspect the site and verify all measurements and conditions. No extra compensation will be allowed because of differences between work shown on the drawings and measurements at the site.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. The Drawings are diagrammatic in nature, but the locations of devices, equipment, outlets, and lighting fixtures are shown approximately where installations are intended. Architectural, structural, mechanical, audio/video, theatrical lighting and other drawings shall be examined, noting all conditions that may affect this work. Report conflicting conditions to the Architect/Engineer for adjustment before proceeding with the work. Should the Contractor proceed with work without reporting the matter, he does so on his own responsibility and shall alter work if directed by the Architect/Engineer at his own expense.
- E. Examine the architectural, structural, mechanical, fire sprinkler and manufacturer's drawings for various equipment in order to determine exact routing and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment enclosure.
- F. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Owner reserves the right to require minor changes in location of outlets or equipment, prior to rough in without incurring any additional cost or changes.
- G. If significant departures from the Drawings or Specifications are considered necessary by the Contractor, details of the changes and the reasons therefore shall be submitted to the Architect as within thirty days after award of contract. Prior written acceptance of the Architect is required for these departures.
- H. Clarification of plans and specifications for the purpose of facilitating construction, but not involving additional labor and materials, may be prepared during construction by the Architect/Engineer. Said revised plans and specifications shall become a part of the contract. The Contractor shall conform to the revised plans and specifications at no additional cost to the Owner.

1.07 CODES, STANDARDS, RULES AND REGULATIONS

- A. All work and materials shall be in full accordance with the latest rules, codes, and/or regulations and not limited to the following:
- B. NFPA 70 - National Electrical Code; National Fire Protection Association, 2020 with 2022 California Electrical Code amendments
- C. NFPA 101 - Life Safety Code
- D. NFPA 72 - Fire Alarm Code

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Title 24 - State of California Administrative Code
- F. California Building Code (CBC)
- G. City or County Electrical Code as applicable.
- H. Utility rules and regulations.
- I. Any applicable additional codes and regulatory documents effective at the project site.
- J. Nothing on the Drawings or in the Specifications shall be construed to allow work not in conformance with these rules, codes, and regulations.
  - 1. The Drawings and/or Specifications shall take precedence where work and material described therein exceeds that required by rules, codes, or regulations.

1.08 MANUFACTURER'S INSTRUCTIONS

- A. Follow the manufacturer's instructions when specific installation or connection details are not indicated or specified on the contract documents.
- B. Notify the Architect/Engineer of conflicts between the manufacturer's instructions and installation or connection details prior to the installation of materials.

1.09 WORKMANSHIP

- A. High quality workmanship shall be evidenced in the installation of all electrical equipment and materials. Use the National Electrical Contractors Association's "Standard of Installation" as a guide to the workmanship required. Be prepared to replace or repair any material or equipment damaged by or installed in a manner exhibiting evidence of poor workmanship.

1.10 COORDINATION WITH OTHER TRADES

- A. Examine the Electrical Drawings and refer to the Drawings and Specifications describing other work to be accomplished. Verify and coordinate prior to bid. Continue to coordinate work planning and all work in the field to avoid conflicts, errors, and/or delays. No compensation will be allowed for extra work necessitated by lack of coordination.

1.11 AUTHORITY OF THE ARCHITECT

- A. As used in this paragraph only, the word "Architect" shall mean the Architect of record or his designated representative.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. The authority of the Architect shall be absolute with respect to all performance under this Specification. In case of dispute, the decision of the Architect shall be final.
- C. Where optional materials, methods, or installation techniques are allowed under the provisions of this Specification, they may be used at the discretion of the Architect. The Architect may require specific materials, methods, or techniques to be used in specific situations where use of other materials, methods, or techniques might in his judgment result in loss of aesthetics, accidental damage, life safety hazard, or loss of utility over the system design lifetime.
- D. No additional charges will be allowed for work or material require to be supplied under the conditions of this paragraph unless the need for such material or work could not have been anticipated by thorough study of the site, Drawings, and Specifications and knowledge of all applicable codes, laws, and ordinances.

1.12 EXAMINATION OF THE SITE

- A. The contractor is required to visit the site of construction prior to bid to determine existing conditions and their effect upon the work he will be required to perform. No additional compensation will be allowed for any extra expenses incurred by failure to detect and evaluate all existing conditions that will affect his work to be included in the bid to accomplish this contract document's goal.

1.13 STRUCTURAL REQUIREMENTS

- A. Secure all anchors for electrical equipment in a manner, which will not decrease the structural value of any structure to an unsafe level. Install all equipment, fixtures, etc. to resist seismic movements. Inform the Architect in advance and provide drawings of any proposed modifications to the structure that involves cutting or patching of concrete, masonry, steel, or wood in this project.

1.14 PERMITS, FEES, AND, INSPECTIONS

- A. Obtain all permits and licenses as required and pay all fees incidental to construction.
- B. Inspections required by prevailing Local Authorities, and/or ordinances, shall be coordinated and arranged by the contractor. Provide the Architect with a schedule of inspections, where applicable, and submit all certificates of inspection to the Architect.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. The Contractor shall cooperate with the Architect and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate equipment, or perform any reasonable work, which, in the opinion of the Architect, will be necessary to determine the quality or adequacy of the work. Work shall not be closed in or covered before inspection and approval by the Architect. Cost of uncovering and making repairs where un-inspected work has been closed in shall be borne by the Contractor. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Architect, remove the materials from the premises.

1.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable to the Owner. Secure material from weather or accidental damage.

1.16 SEQUENCING AND SCHEDULING

- A. Sequence work under provisions of Division 1.
- B. Coordinate the incoming electrical, telephone and cable television services with the local serving utility companies. Install utility service trench and duct systems in accordance with the respective serving utility company requirements.
- C. Coordinate hand hole locations with the existing site conditions. Hand holes are to be located approximately five feet from building or as indicated on drawings.

1.17 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY

- A. The contractor shall provide short circuit, protective device and arc flash studies for the complete electrical distribution system. Submit to the Electrical Engineer of Record for review. Provide all short circuit device and equipment characteristic information for all electrical components. Provide Time-Current curves for all overcurrent protective devices in the submittal. Set and adjust all devices in accordance with the results of this study prior to energizing equipment. Refer to Section 26 05 73, Power Systems Studies for additional requirements.
- B. The Contractor shall be responsible for obtaining all pertinent information necessary in order to perform the required short circuit, protective device coordination and arc flash studies to include but not limited to the following:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Contacting the serving power utility to obtain the available short circuit current at the project point of connection and/or secondary of the serving utility company service transformer(s).
2. Field investigation to determine the short circuit current rating for any existing electrical service and distribution equipment.
3. Electrical characteristics for all proposed new electrical service and distribution equipment.
4. The Contractor shall provide approved permanent labels for all electrical service and distribution equipment to clearly identify the available short circuit current and arc flash energy levels and required PPE (Personnel Protective Equipment).

1.18 OPERATING INSTRUCTIONS

- A. Instruct the Owner as to function, operation, maintenance, and adjustment of each system and piece of equipment provided.

1.19 RECORD DRAWING

- A. The Contractor shall keep a separate set of Electrical Drawings at the job site to be used as RECORD Drawings. These Drawings are to be kept current and in a neat and clean condition at all times. They are to be available for inspection by the Architect or Engineer at any time during site visitations. These Drawings shall be "red lined" to indicate all changes in equipment, device, and outlet locations; and to indicate the true locations of all concealed or underground work where different from that shown on the Drawings. Each sheet of this set shall be clearly and permanently marked "RECORD DRAWINGS".
- B. Upon completion of the project and prior to final payment, transfer all RECORD DRAWINGS information to the provided original drawings. All information shall be clearly drawn with "RED" ink. The drawings shall be scanned, 100% edited, and converted into an AutoCAD ".dwg" version 2011 (or higher) electronic file. Deliver the original, final sets, and electronic files (CD) to the Architect for review and delivery to the Owner.

1.20 SPARE PARTS

- A. Spare parts shall be provided and maintained by the Contractor to support the maintenance response requirements defined in this document.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. At a minimum, the following spare parts shall be stored onsite at a location identified by the Owner's representative. The spare parts shall be the property of the Owner. The spare parts shall be of the same type submitted and installed in the facility to include the following:
- C. Lighting fixture LED driver, one for each fixture type.
- D. Branch circuit panelboard circuit breaker, one for each circuit breaker type.
- E. Fuses, one set of three for each fuse type and size.
- F. Lighting occupancy sensors and switches, one for each sensor and switch type.

1.21 GUARANTEE

- A. All electrical work, material, and equipment shall be guaranteed to be free from defects in workmanship or material for a period of two (2) year from the date of final acceptance. Repair or replace all such defects in a timely manner and any damage to the owner's property resulting from such defect or repair thereof. All equipment and material provided and all work accomplished under the requirements of this section shall be at no expense to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Unless specifically indicated otherwise, all material shall be new and free from defects; it shall be listed by Underwriters' Laboratories where applicable. Like items shall be of the same manufacturer (except lighting fixtures - which shall be as specified).
- B. Except as noted otherwise, where material of a particular manufacturer is specified, the intent is to describe the quality and function of the item. The term "...or acceptable equal" is implied. A substitution of any of these items will require that the item be presented in a submittal whether specifically listed in the "Submittals" paragraph below or not.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.02 SUBMITTALS

- A. Material submittals shall be complete and submitted all at the same time. The individual groups of submittal types (e.g.: lighting fixtures, wiring devices, distribution equipment, etc.) MUST be prefaced with a list of contents identifying each item by its project name or symbol, manufacturer, and complete catalog number. Each copy of each submittal group shall have the list of contents attached. These lists will be used to report submittal comments. The Contractor is responsible for submitting this information in a timely manner so that material may be ordered early enough to meet the construction schedule. If material is not ordered in time for whatever reason, pay such premium prices and special handling charges as are required to meet the construction schedule. No substitution of an "accepted" item will be allowed due to failure to plan for adequate material procurement lead time.
- B. Shop drawings shall be drawn to scale or completely dimensioned and shall give all information required to completely describe the item. The Contractor shall carefully check all the shop drawings for compliance with these specifications and the Plans.
- C. If the shop drawings show variations from the Contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in order that if (acceptable) suitable action may be taken for proper adjustment of the Contract. The Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract, even though the shop drawings have been reviewed.
- D. Work requiring shop drawings shall not be started before receipt of the Architect's review and acceptance.
- E. The Architect's/Engineer's review of the submitted materials, items and shop drawings are for general compliance with the plans and specifications and general design and arrangement only. Therefore, it shall not relieve the Contractor from responsibility for errors of any sort in the materials, items, shop drawings or schedules. The Contractor shall verify all dimensions and job site conditions affecting the work, and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the drawings and specifications.
- F. As a minimum, submittals are required for the following items:
  - 1. RACEWAY COMPONENTS
  - 2. WIRE AND CABLE

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. WIRING DEVICES
4. PANELBOARDS
5. PULL BOXES
6. SAFETY SWITCHES, DISCONNECTS AND CIRCUIT BREAKERS
7. TRANSFORMERS
8. LIGHTING FIXTURES, CONTROL SYSTEMS, PEDESTALS AND POLES

2.03 SUBSTITUTIONS

- A. Specific brand names and catalog numbers are used to describe materials in order to establish of performance and quality.
- B. Only one substitution will be considered for any item. Substitute materials must be equal in quality and function to that specified. Allowance of a substitution does not permit any reduction of system performance or utility, and the Contractor is responsible for additional costs incurred due to use of a substituted item. If the proposed substitute item is "rejected", the specified item shall be provided (re-submittal required) without further discussions or delay.
- C. Any Contractor's proposed substitution of material, article, or method in the opinion of the Architect/Engineer are equal to that specified will be accepted, provided the Contractor submits a single written request, in triplicate, to the Architect, with the following information for each item:
  - D. Name of Manufacturer or supplier.
  - E. Trade or brand names.
  - F. Type, model, style, and/or catalog number.
    1. Size or capacity rating.
- G. After receipt of a written request from the contractor, the engineer of record will review product substitutions fourteen (14) days prior to the bid date. If system substitutions are submitted after the award of the project contract, the analysis for the whole system substitution will be charged to the contractor at senior engineer hourly rates.
- H. The decision of the Architect/Engineer shall govern as to what is equal to the item specified in the plans and specifications. Equality will be judge on the basis of the following:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Conformance with description or performance required.
  2. Equal in quality.
  3. Comparable in appearance and artistic effect where these are in considerations.
  4. Comparable operation, maintenance and performance.
  5. Equal in longevity and service under conditions of climate and usage.
  6. Conformance with space allocations and requirements for operations from in details and construction of related work.
  7. Conformance with all applicable codes and regulations.
- I. If the Architect/Engineer considers it necessary, tests to determine the quality of the proposed materials shall be made, at the expense of the Contractor, by an unbiased laboratory, satisfactory to the Architect.

2.04 ENCLOSURES

- A. Provide enclosures suitable for the specific type of location in which they are installed.
1. Provide NEMA 1 or NEMA 12 boxes and enclosures for dry locations. Dry locations are all indoor areas that do not fall within the definitions below for wet or damp locations.
  2. Provide NEMA 3R boxes and enclosures for wet locations. Wet locations are all locations exposed to weather, whether under a roof or not.
  3. Provide NEMA 4 boxes and enclosures for damp locations. Damp locations are all indoor spaces wholly or partially underground or any area subject to water spray.
  4. Provide NEMA 4X, stainless steel enclosures in all kitchen and wash down areas.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All equipment shall be set square and plumb, securely mounted, adequately supported, and permanent. Provide workspace around items of electrical equipment as required by California Electrical Code (CEC). In general, equipment is to be installed in accordance with manufacturer's instructions; but the requirements of these specifications shall take precedence where conflicts exist.
- B. WIRING METHODS: The cables and conductors of all systems specified in the Specification are required to be installed in raceway.
- C. Coordinate electrical work with the Owner's representative and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the facility during construction.
- D. Check and coordinate the approximate locations of electrical stub-ups, light fixtures, electrical outlets, equipment, and other electrical system components shown on the Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify the architect in writing. The architect's decision shall govern. Make modifications and changes required to correct conflicts as required.

3.02 ELECTRICAL WORK FOR EQUIPMENT PROVIDED UNDER OTHER SECTIONS

- A. Install power conductors and terminate on equipment provided under other specification sections. Verify specific requirements.
- B. Install and terminate electrical controls as described on the Electrical Drawings (For mechanical equipment specified in Division 23).
- C. Line voltage control wiring of exhaust fans is to be accomplished under this Division. The controlling device may be specified elsewhere.
- D. Provide and install all disconnect/safety switches and motor starters except those devices specified to be furnished with equipment specified elsewhere.
- E. Unless provided for in another Division, install all items of electrical equipment provided by others.
- F. Assist others in equipment testing to verify that wiring and connections made under this Division are correct.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.03 EQUIPMENT IDENTIFICATION

- A. Nameplates shall be installed on all items of electrical equipment as follows: switchboard(s) and switchboard circuit breakers, panelboards, terminal cabinets, time switches, contactors, motor control switches, wall switches (where noted on the Drawings), motor starters provided under this Division where the function is not immediately obvious, and safety switches.
- B. The nameplate shall identify the item by Drawing name where applicable and describe its use or function in this installation.
- C. Permanently mark all utility outlets to show source of power panel and circuit breaker number.
- D. Provide nameplates per Section 26 05 53.

3.04 EXCAVATION AND BACKFILL

- A. Excavation and backfill shall be accomplished as required for installation of electrical equipment as shown on the Drawings. Restore all surfaces, roadways, walks, etc., and any existing underground structures which might be disturbed during this work to their original condition in a manner acceptable to the Architect.
- B. Trenches shall be straight except where otherwise indicated. Depth shall be as noted on the Drawings and at least as required to provide the minimum cover specified by applicable codes and regulations for the equipment installed. Bottom of trench shall be smooth and free of any rock points. Place a 4" sand bed in trench if these conditions cannot be met with native material.
- C. Backfill shall be clean and free of rocks and debris. Backfill is to be tamped in 6" layers to nominal 95% compaction using a mechanical tamper manufactured specifically for this purpose. In an area of engineered fill or other area of specified compaction, backfill shall be compacted to match that specified for that area.
- D. At a depth of 12" below finished grade and at least 6" above installed equipment, lay a 6" wide yellow warning tape on the compacted backfill for the full length of the trench. Do not stretch the tape. Use Brady "Identoline" stating: "CAUTION BURIED ELECTRICAL LINE". Installation under building slabs is not required unless noted otherwise.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. If at any time during a period of one-year dating from the date of final acceptance of the project, there shall be any settlement of conduit trenches, the Architect may notify the Contractor to immediately provide additional fill and to make such repairs or replacements in paving, planting, or structures, as may be deemed necessary at the Contractor's expense.
- F. Cooperate and coordinate with others in planning for and execution of all trench work.
  - 1. The Contractor is expected to exercise due care when excavating in an area of existing utilities to avoid damage to these facilities. Where it can be determined that underground facilities are likely to exist (either from the Drawings or inspection of the site), the Contractor is required to determine the exact locations of these existing installations. Damage to existing facilities, due to failure to properly accomplish the above, shall be repaired at the Contractors expense to the approval by the Architect and satisfaction of the Owner.
  - 2. CALL AN UNDERGROUND SERVICE FIRM BEFORE TRENCHING, CALL U.S.A. (800) 624-2444.

3.05 SEALING PENETRATIONS

- A. Flash and counter flash roof and wall penetrations with equipment manufactured for the purpose and as described in other Divisions of these Specifications or as Directed by the Architect. Apply mastic as required to seal absolutely watertight.
- B. Conduits penetrating floor slabs or block or concrete walls shall be grouted and sealed watertight.

3.06 CUTTING AND PATCHING

- A. Obtain the Architect's acceptance prior to cutting existing surfaces or surfaces under construction. All such surfaces must be repaired or patched to the satisfaction of the Architect.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.07 EQUIPMENT ANCHORING

- A. Seismic Withstand Requirements: Freestanding or wall-hung equipment shall be anchored in place by methods, which will meet the requirements of the applicable codes for seismic loads. The contractor shall submit calculations in accordance with "Contractor Submittals", for the design of the anchoring systems for all equipment, including panels, transformers, etc. in excess of 250 pounds. Calculations shall be performed, signed and stamped by a Structural Engineer or a Civil Engineer experienced in structural design and licensed in the State of California. The calculation shall provide an analysis of lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. The calculation shall also provide an analysis of both the anchoring system and the foundation or wall system to receive the anchor loads and shall show that the foundation is capable of resisting all anchor loads. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria.
- B. Seismic bracing for light fixtures cable or pendant suspended from ceiling or roof structure shall be seismically braced to prevent fixture from swaying 45 degree in either direction of suspension point. Contractor shall use same cable used to suspend light fixture. Where pendants are used the contractor shall use air craft light fixture suspension cable. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria referred to in above paragraph.

3.08 HOUSEKEEPING PADS AND FOUNDATIONS

- A. Concrete work required for housekeeping pads and foundations shall be provided by General Construction Work.
- B. Furnish required dimensional drawings and specify locations for all equipment pads and foundations. Minimum height of housekeeping pads shall be four inches and shall extend out six inches from the footprint of the equipment. Extend pad dimensions where required to maintain accessibility and meet all code requirements.
- C. Furnish anchor bolts and sleeves, verify accuracy of installation.
- D. Provide housekeeping pads for the following:
  - 1. Outdoor floor-mounted transformers.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.09 PROTECTION CLEANING AND REPAIRS

- A. All electrical equipment shall be protected from damage or degradation during construction. Electrical equipment stored or installed shall be protected from dust, water, or damage from other sources.
- B. After all other work has been accomplished, such as plastering, painting, etc., and prior to final review by the Architect; all electrical equipment, especially equipment enclosures, panelboards, switchboards, and lighting fixtures shall be thoroughly cleaned (inside and out) of all dirt, water, grease, plaster, paint, or other construction debris. All surfaces shall be clean and in "new" condition. All scratches, dents, marks, cracks, etc., shall be repaired to the satisfaction of the Architect or the equipment shall be replaced at no additional cost.

3.10 ELECTRICAL EQUIPMENT DELIVERABLES

- A. Retain and safeguard all detachable and spare devices, equipment, and literature (O&M manuals, instruction books, wiring diagrams, test reports, keys, fixtures, etc.) until completion of work. At this time, all items will be delivered to the Owner as directed by the Architect.

3.11 TESTS

- A. Prior to energization of equipment, check the insulation resistance of listed circuits, with a 500 volt "Megger".
- B. Take precaution during the testing period to insure the safety of personnel and equipment.
- C. Test all wiring for continuity and grounds before any fixtures or equipment are connected. Where such tests indicate faulty installation or other defects, the fault(s) shall be located and repaired at the Contractor's expense. The repaired installation shall then be retested.
- D. Verify rotation of all three phase motors and reconnect if necessary.
- E. Verify the resistance of the grounding electrode system(s).
- F. Balance all loads on each panelboard and all other types of distribution equipment as applicable.
- G. Provide all site testing.

3.12 ADJUSTING

- A. Inspect all equipment and put into good working order.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.13 CLEANING

- A. Clean work under provisions of Division 1.
- B. Clean all electrical items. Fixtures and equipment shall be free of dirt, dust and other construction debris.

3.14 START UP

- A. Operate all electrical systems in good working order for a period of five consecutive days at a time period agreed to by the Owner's representative.

END OF SECTION 26 05 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 05  
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.
- B. The requirements of this Section are in addition to the requirements of Division 1 – General Conditions and Supplementary Conditions.

1.02 RELATED REQUIREMENTS

- A. Section 01 77 00 - Execution and Closeout Requirements: Additional requirements for alterations work.
- B. Section 02 41 19 – Selective demolition.
- C. Section 26 05 00-Common Work Results for Electrical.

1.03 SUBMITTALS

- A. See Section 01 30 00-Administrative Requirements, for submittal procedures.
- B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

1.04 REQUIREMENTS INCLUDED

- A. The Contractor shall furnish materials, equipment, and labor necessary to perform and complete demolition work.
- B. The work includes demolition of the existing electrical system and equipment.
- C. The work shall include, but not limited to. Removal of existing electrical equipment and devices, conduits, and wiring.
- D. Manufactured articles, materials, equipment, and accessories shall be demolished in accordance with the manufacturer's specifications and recommendations, and industry standards.
- E. Notify the Owner's Representative at least 72 hours prior to any electrical systems shutdown and receive approval prior to proceeding.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.05 PROTECTION

- A. It is essential that there be minimal interruption of existing systems such as power, fire protection, and other systems, in addition to the normal operations of the Owner's facilities.
- B. Take care to ensure that there will be no damage to structural elements or portions there-of-which are not to be removed. Erect and maintain temporary shoring, bracing and other means to safeguard the structural integrity of the existing building(s) and structures.
- C. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other means to protect the public, workers, and other persons; finishes, and improvements to remain; and adjoining property from damage from demolition work; all in accordance with applicable regulatory requirements.
- D. Protect existing structures, facilities, and plant life from damage. Items damaged as a result of demolition operations shall be repaired or replaced, at no cost to the Owner.
- E. Perform demolition to provide the least interference and most protection to existing facilities and improvements to remain.
- F. Demolish concrete in small sections.
- G. Perform demolition as much as possible with small tools.
- H. Jackhammering:
  - 1. Jackhammering will be permitted only to a limited degree, and only with the prior written approval of the Owner.
  - 2. Do not jackhammer within 2-inches of reinforcing or structural steel to remain; remove final 2-inches of material with chipping gun.

1.06 CUTTING AND PATCHING

- A. Make new openings neat, as close as possible to profiles indicated, and only to extent necessary for new work.
- B. Do not cut or alter structural members unless specifically indicated or approved, and do not damage reinforcing or structural steel to remain.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. At concrete, masonry, paving, and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and coring equipment. Do not over cut at corners of cut openings – saw overruns will not be permitted. Core hole at corner of proposed openings to insert blade and chip square.
- D. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.
- E. Repair and patch all holes and openings from the removed electrical equipment, outlet boxes, etc.: Coordinate with the General Contractor and Architect to include and provide finishes to match adjacent surfaces.

1.07 PIPES, DUCTS AND CONDUITS

- A. Remove deactivated electrical conduits, including fasteners, connections, and other related appurtenances and accessories which would otherwise be exposed in the completed work or interfere with construction operations.
- B. Unless noted otherwise, remove existing exposed conduits and abandon existing concealed conduits in walls, ceilings and underground whether shown on drawings or not.
- C. Cap deactivated piping systems at point of cutoff.

1.08 **DEMOLITION DEBRIS**

- A. All demolished equipment and associated materials must be disposed of in an approved manner and in accordance with all applicable federal, state and local laws.
- B. Regularly remove debris from the site so that it's presence will not delay the progress of the work.
- C. Nothing removed from the site shall be stored, sold, or burned on site without the Owner's prior written acceptance.

1.09 RECONDITIONING EXISTING SUBSTRATES

- A. Clean surfaces on which new materials will be applied, removing adhesives, bitumen, and other adhering materials, as necessary to furnish acceptable substrates for new materials.
- B. Perform sandblasting, chipping, grinding, acid washing, etching, and other work as required by conditions encountered and new materials involved.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Use of acids or other cleaning agents shall include neutralizing, washing, rinsing, and drying, as applicable.
- D. Determine substrate requirements for reconditioned surfaces in cooperation with the manufacturer's representative and installer of each new installer involved.

1.10 DISPOSAL OF FLUORESCENT LAMPS AND BALLASTS

- A. All existing fluorescent lamps and ballasts shall be properly disposed or recycled according to the Environmental Protection Agency (EPA) and Resource Conservation and Recovery Act (RCTA) standards. Include all costs for disposal or recycling in the bid proposal.
  - 1. Lamps: Dispose or recycle through "Allied Technology Group", 47375 Fremont Blvd., Fremont, CA, 94538, (510) 490-3008 or equal.
  - 2. Ballasts: Dispose or recycle through "Fulcircle Ballast Recyclers", 550 Montori Court, Pleasanton, CA, 94556, (510) 417-5967 or equal.

1.11 ASBESTOS

- A. In the event asbestos is found to be present in areas conflicting with electrical work, before continuation of work in these areas, notify the General Contractor and/or Owner's Representative and if applicable, for the removal of such hazardous material by a certified asbestos contractor.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on field observation and existing record documents.
- D. Report discrepancies to Architect and Owner before disturbing existing installation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Report discrepancies to Electrical Engineer on Record before disturbing existing installation.
- F. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with Section 02 84 00 and applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
  - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
  - 2. PCB- and DEHP-containing lighting ballasts.
  - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- B. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Scope: furnish all labor, materials, equipment, and incidentals required to install wire and cable for a complete operable electrical system as shown on the drawings and as described in the specifications.
- B. Section Includes:
  - 1. Single conductor building wire
  - 2. Wire and cable for 600 volts and less.
  - 3. Wiring connectors.
  - 4. Electrical tape.
  - 5. Heat shrink tubing.
  - 6. Oxide inhibiting compound.
  - 7. Wire pulling lubricant.
  - 8. Cable ties.
  - 9. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00-Common Work Results for Electrical.
- B. Section 26 05 05 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation 2018 (Reapproved 2023).
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.
- I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation) 2008a (Validated 2019).
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- N. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- P. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- Q. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- R. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.
- D. Product Data: Provide for each cable assembly type.
- E. Test Reports: Indicate procedures and values obtained.
- F. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- G. Field Quality Control Test Reports.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
- K. Project Record Documents: Record actual locations of components and circuits.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. All wire and cable shall comply with applicable standards of the Underwriters Laboratories Inc.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify the Electrical Engineer or Record and obtain direction before proceeding with work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.09 PROJECT CONDITIONS

A. Existing Conditions

1. Wire and cable routing shown on the Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
2. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

B. Verify that field measurements are as shown or indicated on the Drawings.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Concealed Dry Interior Locations: Use only building wire in raceway.
- D. Exposed Dry Interior Locations: Use only building wire in raceway.
- E. Above Accessible Ceilings: Use only building wire in raceway.
- F. Wet or Damp Interior Locations: Use only building wire in raceway.
- G. Exterior Locations: Use only building wire with Type THWN/THW insulation in raceway.
- H. Underground Installations: Use only building wire with Type THWN/THW insulation in raceway.
- I. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- J. Use stranded conductors for control circuits.
- K. Use conductor not smaller than 12 AWG for power and lighting circuits.
- L. Use conductor not smaller than 14 AWG for control circuits.
- M. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- N. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 150 feet.
- O. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2.02 WIRE MANUFACTURERS (LISTED IN ALPHABETICALLY ORDER ONLY AND NOT NECESSARY BY PREFERENCE)

- A. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
- B. Industrial Wire & Cable, Inc: [www.iewc.com](http://www.iewc.com).
- C. Southwire Company: [www.southwire.com](http://www.southwire.com).
- D. Or approved equal.
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide conductors and cables with lead content less than 300 parts per million.
- D. Provide new conductors and cables manufactured not more than one year prior to installation.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- F. Comply with NEMA WC 70.
- G. Comply with FS A-A-59544 where applicable.
- H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- J. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- K. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- L. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.
- M. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- N. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- O. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
    - 2. Control Circuits: 14 AWG.
- P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- Q. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:

- a. 480Y/277 V, 3 Phase, 4 Wire System:
  - 1) Phase A: Brown.
  - 2) Phase B: Orange.
  - 3) Phase C: Yellow.
  - 4) Neutral/Grounded: Gray.
- b. 208Y/120 V, 3 Phase, 4 Wire System:
  - 1) Phase A: Black.
  - 2) Phase B: Red.
  - 3) Phase C: Blue.
  - 4) Neutral/Grounded: White.
- c. Equipment Ground, All Systems: Green.
- d. Isolated Ground, All Systems: Green with yellow stripe.
- e. Travelers for 3-Way and 4-Way Switching: Pink.
- f. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
- g. For control circuits, comply with manufacturer's recommended color code.

2.04 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

- 1. Copper Building Wire:
  - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
  - b. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. General Cable Technologies Corporation  
: [www.generalcable.com/#sle](http://www.generalcable.com/#sle).
  - d. Service Wire Co: [www.servicewire.com/#sle](http://www.servicewire.com/#sle).
  - e. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
- 1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
  - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
- 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
    - a. Size 4 AWG and Larger: Type XHHW-2 or THHN/THWN.
    - b. Installed Underground: Type XHHW-2 or THHN/THWN.
    - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
- F. Conductor: Copper.
- 1. For Sizes Smaller Than 4 AWG: Copper.
  - 2. For Sizes 4 AWG and Larger: Copper.
- G. Insulation Voltage Rating: 600 volts.
- H. Insulation: NFPA 70, Type THHN/THWN.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  - 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
  - 7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:

- a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
- b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
- c. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufacturers:

- a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
- b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
- c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration with prestressed insulation to equal the insulation of wire being installed. .

1. Manufacturers:

- a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
- b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
- c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Manufacturers:
  - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
  - b. IlSCO: [www.ilSCO.com/#sle](http://www.ilSCO.com/#sle).
  - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - d. Or approved equal.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

K. Power Conductor Splicers

1. Blackburn.
2. Burndy "Hylug".
3. Ilso.
4. O.Z. Gedney.

2.06 ACCESSORIES

A. Electrical Tape:

1. Manufacturers:
  - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
  - b. Plymouth Rubber Europa: [www.plymouthrubber.com/#sle](http://www.plymouthrubber.com/#sle).
  - c. Or approved equal.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
  5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
  6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
  7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

D. Wire Pulling Lubricant:

1. Manufacturers:

- a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
- b. American Polywater Corporation: [www.polywater.com/#sle](http://www.polywater.com/#sle).
- c. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.

1. Manufacturers:

- a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
- b. Scotchflex.
- c. Thomas & Betts.
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

1. Products:

- a. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
- b. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
- c. Substitutions: See Section 01 60 00 - Product Requirements.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
- b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that raceway installation is complete and supported.
- E. Verify that field measurements are as indicated.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
  1. Unless dimensioned, circuit routing indicated is diagrammatic.
  2. When circuit destination is indicated without specific routing, determine exact routing required.
  3. Arrange circuiting to minimize splices.
  4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
  5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
  - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
  - b. Increase size of conductors as required to account for ampacity derating.
  - c. Size raceways, boxes, etc. to accommodate conductors.
  - d. Record any circuit changes on record drawings.
8. Common Neutrals: Sharing of neutral/grounded conductors among branch circuits is not permitted.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
  - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
  - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
  1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  2. Pull all conductors and cables together into raceway at same time.
  3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
  - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- G. Terminate cables using suitable fittings.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
  - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  - 3. Do not remove conductor strands to facilitate insertion into connector.
  - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
  - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
  - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
    - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
  2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  3. Wet Locations: Use heat shrink tubing.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Identify conductors and cables in accordance with Section 26 05 53.
- Q. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- T. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.
- U. Route wire and cable as required to meet project conditions.
  - 1. Wire and cable routing indicated is approximate unless dimensioned.
  - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
  - 3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.
- V. Use wiring methods indicated.
- W. Pull all conductors into raceway at same time.
- X. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- Y. Protect exposed cable from damage.
- Z. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
- AA. Use suitable cable fittings and connectors.
- BB. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- CC. Clean conductor surfaces before installing lugs and connectors.
- DD. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- EE. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- FF. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- GG. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

HH. Trench and backfill for direct burial cable installation as specified in Sections 31 2316 and 31 2323. Install warning tape along entire length of direct burial cable, within 3 inches of grade, as specified in Section 26 0553.

II. Identify and color code wire and cable under provisions of Section 26 0553. Identify each conductor with its circuit number or other designation indicated.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect wire for physical damage and proper connections.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's values.

D. Perform field inspection and testing in accordance with Section 01 4000.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

G. Correct deficiencies and replace damaged or defective conductors and cables.

H. Perform field inspection

I. Megger test and record all feeder conductors.

1. Replace conductors failing test.

2. Test replaced conductors in same manner.

END OF SECTION 26 05 19

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: provide a complete grounding and bonding system as shown on the electrical drawings and as described in the specifications such that the entire raceway system including all equipment enclosures, data racks, telephone backboards and cabinets, fixtures, and outlets, etc. are effectively connected to ground.
- B. Grounding and bonding requirements.
- C. Section includes:
  - 1. Materials and methods for grounding systems and equipment.
  - 2. Grounding electrodes and conductors.
  - 3. Equipment ground conductors.
  - 4. Bonding
  - 5. Grounding well.
  - 6. Ground bars.
  - 7. Chemically enhanced ground electrodes.
  - 8. Ground plate electrodes.
- D. Connectors for grounding and bonding.
- E. Ground rod electrodes.
- F. Chemically-enhanced ground electrodes.
- G. Ground plate electrodes.
- H. Ground enhancement material.
- I. Ground access wells.
- J. Pre-fabricated signal reference grids.
- K. Provide all components necessary to complete the grounding system(s) consisting of:



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Metal underground water pipe.
2. Metal frame of the building.
3. Concrete-encased electrode.
4. Existing metal underground gas piping system.
5. Metal underground gas piping system.

#### 1.02 RELATED REQUIREMENTS

- A. Section 26 05 00-Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:  
Additional requirements for conductors for grounding and bonding, including  
conductor color coding.
  1. Includes oxide inhibiting compound.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products  
and requirements.
- D. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding  
requirements for pole-mounted luminaires.

#### 1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and  
Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode  
Couplings 2022.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical  
Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority  
Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 99 - Health Care Facilities Code 2024.
- G. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2023.
- H. UL 467 - Grounding and Bonding Equipment Current Edition, Including All  
Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

#### 1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance:

1. Building grounding electrode: 10 ohms.
2. Separately Derived Sources Grounding Electrode: 10 ohms
3. Non-current carrying metal parts: 25 ohms
4. Grounds not covered above: 25 ohms

#### 1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Shop Drawings:
1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
- D. Product Data: Provide for grounding electrodes and connections.
- E. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Field quality control test reports.
- H. Project Record Documents: Record actual locations of grounding electrode system components and connections.
- I. Project Record Documents: Record actual locations of components and grounding electrodes.
- J. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

#### 1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Electrical Engineer of Record. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
  - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
  - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Ring:
  - a. Where indicated on drawings, provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
  - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
  - c. Provide ground enhancement material around conductor where indicated.
  - d. Provide connection from ground ring conductor to:
    - 1) Perimeter columns of metal building frame.
    - 2) Ground rod electrodes located as indicated.
    - 3) Building structural steel.
6. Ground Rod Electrode(s):
  - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
  - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
  - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Provide ground enhancement material around electrode where indicated.
  - e. Provide ground access well for each electrode.
7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
  8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    - a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
  9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
  2. Provide equipment grounding conductor routed with supply conductors.
  3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
  4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
    - a. Transformers (except autotransformers such as buck-boost transformers).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
  - c. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
  3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
  5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
  7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- I. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
    - c. Metal process piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame.
  10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
  11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
  12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- J. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
  - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
  - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
  - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
  - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

## 2.02 GROUNDING AND BONDING COMPONENTS

### A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

### B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.
  - a. Exceptions:
    - 1) Use bare copper conductors where installed underground in direct contact with earth.
    - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

### C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    - a. Exceptions:
      - 1) Use mechanical connectors for connections to electrodes at ground access wells.
  3. Unless otherwise indicated, use mechanical connectors for accessible connections.
    - a. Exceptions:
      - 1) Use exothermic welded connections for connections to metal building frame.
  4. Manufacturers - Mechanical and Compression Connectors:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
    - b. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - e. Or approved equal.
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
  5. Manufacturers - Exothermic Welded Connections:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - c. Or approved equal.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
  2. Material: Copper-bonded (copper-clad) steel.
  3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
  5. Manufacturers:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
    - b. Galvan Industries, Inc: [www.galvanelectrical.com/#sle](http://www.galvanelectrical.com/#sle).
    - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Chemically-Enhanced Ground Electrodes:
1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
  2. Length: 10 feet.
  3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
  4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
  5. Manufacturers:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
    - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Ground Plate Electrodes:
1. Material: Copper.
  2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Or approved equal.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

G. Ground Enhancement Material:

1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Resistivity: Not more than 20 ohm-cm in final installed form.
3. Manufacturers:
  - a. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - b. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - c. Or approved equal.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Ground Access Wells:

1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
  - a. Areas Exposed to Vehicular Traffic: Rated for not less than 2000 pounds vertical design load.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
  - a. Round Wells: Not less than 8 inches in diameter.
  - b. Rectangular Wells: Not less than 12 by 12 inches.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
  - a. Advanced Lightning Technology (ALT): [www.altfab.com/#sle](http://www.altfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - c. ThermOweld, subsidiary of Continental Industries; division of Burndy LLC: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Or approved equal.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Oxide Inhibiting Compound: Comply with Section 26 05 19.

#### 2.03 MANUFACTURERS

- A. Cooper Power Systems: [www.cooperpower.com](http://www.cooperpower.com).
- B. Framatome Connectors International: [www.fciconnect.com](http://www.fciconnect.com).
- C. Or approved equal.
- D. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.04 ELECTRODES

- A. Manufacturers:
  1. Cooper Power Systems: [www.cooperpower.com](http://www.cooperpower.com).
  2. Framatome Connectors International: [www.fciconnect.com](http://www.fciconnect.com).
  3. Or approved equal.
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Rod Electrodes: Copper.
  1. Diameter: 3/4 inch.
  2. Length: 10 feet.
- C. Foundation Electrodes: 3/0 AWG. unless noted on plan.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

## 2.05 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors: Bronze.
- B. Exothermic Connections: Weld
- C. Wire: Stranded copper.
- D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.
- E. Grounding Well:
  - 1. Well Pipe: 8 inch by 24 inch long clay tile pipe with belled end.
  - 2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Electrodes: Provide a grounding electrode system in the main electrical room/space of each building as follows:
  - 1. Provide a 2-inch x 1/4-inch copper ground bar. Length shall be a minimum of 12 inches but longer as required for the number of connections made to the bar. This bar shall serve as the connection point for all grounding electrodes in the building. Install the copper ground bar in a NEMA 1 screw cover cabinet, minimum size 18 inches x 12 inches x 6 inches.
  - 2. Connect the copper ground bar to the underground metal pipe (other than gas).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Connect to metal pipe with approved pipe clamp near the pressure reducing valve.
  - b. Connect to ground bar with exothermic weld.
  - c. Connect to metal pipe with copper clamp where copper water pipe occurs and with a malleable iron clamp where cast iron pipe occurs.
  - d. Install grounding conductor, sized as indicated on plans, in a 3/4-inch metal conduit from the ground cabinet to the water pipe. Provide grounding bushings at each end of the conduit.
3. Connect the copper ground bar to the metal frame of the building.
- a. At all steel framed buildings, provide a connection to the closest column.
  - b. Connect to column with exothermic weld.
  - c. Connect to the ground bar with exothermic weld or bolted-type connector.
  - d. Install grounding conductor, sized as indicated on the plans, in a 3/4-inch metal conduit from the ground cabinet to the column. Provide grounding bushing at each end of the conduit.
4. Connect the copper ground bar to a concrete-encased electrode/Ufer.
- a. Install a minimum of 20 feet of #3/0 AWG conductor (minimum unless noted otherwise) encased in a minimum of 3 inches of concrete. Provide a non-metallic protective sleeve, minimum 6 inches long (3 inches in the concrete and 3 inches out of the concrete), located where the conductor exits the concrete.
  - b. Install a #3/0 conductor from the ground bar to the concrete-encased electrode in a 3/4-inch metal conduit with grounding bushings. Make connections to the concrete-encased electrode with a bolted-type connector and transition from the metal conduit and non-metallic sleeve.
  - c. Connect to the ground bar with exothermic weld or bolted-type connector.
5. Provide additional ground rod or concrete-encased electrodes as required to meet the performance requirements listed in these specifications at the ground bar.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Install additional ground rods a minimum of 5 feet from any other rod.
  - b. Notify the Owner's Representative if performance requirements have not been met after installing 2 additional ground rods or concrete-encased electrodes.
6. Install other grounding electrodes as indicated on the single line diagram and other Contract Documents.
- D. Grounding Electrode Conductor
1. Install grounding electrode conductor from the main normal and emergency power panels and each separately derived system in the building to the ground bar (grounding electrode system). Install grounding electrode conductor in steel conduit and bond grounding conductor to conduit at entrance and exit. Connect to the ground bar (grounding electrode system) with exothermic weld.
    - a. Unless otherwise indicated, install main ground unspliced.
    - b. Make connections easily accessible for inspection in ground bar cabinet.
  2. Grounding electrode conductor shall be of the same type and quality as other conductors in the building.
  3. The main neutral to ground bonding jumper will be located at the site utilities switchboard. Locate additional neutral to ground bonding jumper at separately derived systems only, or at the main service panel when the building is served from a dedicated transformer. Neutral bar with all interior secondary neutrals shall be isolated from the common equipment grounding bus at all other locations.
- E. Bonding
1. Provide bonding to meet requirements of CEC.
  2. Bond together metal siding not attached to grounded structure, bond to ground.
  3. Bond prefabricated metal building to grounding electrode system at a minimum of one location.
  4. Bond together all metallic conduit, boxes, cabinets, and enclosures.
- F. Grounding Conductors
1. Provide grounding conductor for each branch circuit indicated.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder circuit raceway and within each motor feeder raceway. Terminate each end on suitable lug, bus, or bushing.
3. Provide separate, isolated grounding conductor for each circuit which is installed (all or in part) in non-metallic conduit.
4. Provide separate grounding conductor for circuits installed in flexible steel conduit. Terminate each end on a suitable lug, bus or bushing.
5. Ground all conduit systems, cabinets, equipment, motor frames, etc., in accordance with CEC and applicable codes.

G. Grounding Connections

1. Ground shields of shielded power cable and signal cable at each splice or termination in accordance with recommendations of the splice or termination manufacturer.
2. Ground metal sheathing and exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to that equipment. Provide good electrical contact between metal frames and railings supporting pushbutton stations, receptacles, instrument cabinets, etc., and raceways carrying circuits to these devices.
3. Ground all fencing as shown on the grounding details on the Drawings.
4. Bond neutrals of transformers within buildings to the system ground network, and to additional indicated grounding electrodes.
5. Unless shown otherwise, make connections of grounding conductors to ground rods at the upper end of the rod with the end of the rod and the connection point below finished grade.
6. Make connections of sections of outdoor ground mats (counterpoise) for substations or other equipment underground. Make connections of other grounding conductors generally accessible.
7. In manhole pull boxes, install ground rods with ends 4 to 6 inches above the floor with connections of grounding conductors fully visible and accessible.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

8. When making thermite welds, wire brush or file the point of contact to a bare metal surface. Use thermite welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint. Re-galvanize area if required. For compression connectors, use homogeneous copper, anti-corrosion, surface treatment compound at connectors in accordance with connector manufacturer's recommendations. Use connectors of proper size for conductors and ground rods specified. Use connector manufacturer's compression tool. Notify the Owner's Representative prior to backfilling any ground connections.
  9. Grounding pad plates shall be cast into the slab with the surface flush with the finished floor.
- H. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
  2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
  3. Provide ground well for future access to rod electrodes.
- I. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- J. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Identify grounding and bonding system components in accordance with Section 26 05 53.
- L. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- M. Provide grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.
- N. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing . Bond steel together.
- O. Provide bonding to meet requirements described in Quality Assurance.
- P. Provide isolated grounding conductor for circuits supplying electronic cash registers and other similar electronic equipment loads. .
- Q. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Site Tests:
  1. Test under provisions of Section 26 08 13.
  2. Notify the Owner's Representative five days before inspection and testing.
  3. Use suitable test instruments to measure resistance to ground of systems. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.
  4. Remove main bonding jumper at main service switchboard and at each separately derived system and test for infinite resistance between neutral and ground systems. Reconnect bonding jumper(s) after completion of testing.
  5. Record test results in accordance with Section 26 05 00 and submit.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- F. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 05 26

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 29  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 53 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 00 – Common Work Results for Electrical.
- C. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- G. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023c.
- F. MFMA-4 - Metal Framing Standards Publication 2004.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009.
- H. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006
- I. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010
- J. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2009.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until the concrete has cured; see Section 03 30 53.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.05 SUBMITTALS

- A. See Section 01 33 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
  - 1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Design Data
  - 1. Indicate hanger and support framing and attachment methods.
  - 2. Submit seismic and structural calculations for proposed methods of support and attachment.
- E. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- F. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- G. Installer's qualification statement.
- H. Product Data: Provide manufacturer's catalog data for fastening systems.
- I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at project site one copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: Organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
  - a. NFPA 70.
  - b. Applicable building code.
  - c. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
  - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.
- C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
- 1. Manufacturers:
    - a. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. HoldRite, a brand of Reliance Worldwide Corporation: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
    - e. nVent; Caddy: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - f. Substitutions: See Section 01 66 00 - Product Requirements.
  - 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 3. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- E. Metal Channel/Strut Framing Systems:
- 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  - 2. Comply with MFMA-4.
  - 3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
  - 4. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  - 5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
  - 6. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.
- F. Fiberglass Channel/Strut Framing Systems:
- 1. Description: Factory-fabricated, continuous-slot, fiberglass channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  - 2. Channel Material: Use polyester resin or vinyl ester resin.
  - 3. Minimum Channel Dimensions: 1-5/8 inch wide by 1 inch high.
  - 4. Flammability: Fire retardant with NFPA 101, Class A flame spread index, maximum of 25, when tested in accordance with ASTM E84; self extinguishing in accordance with ASTM D635.
- G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2-inch diameter.
    - b. Busway Supports: 1/2-inch diameter.
    - c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
    - d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
    - e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
    - f. Outlet Boxes: 1/4-inch diameter.
    - g. Luminaires: 1/4-inch diameter.
- H. Anchors and Fasteners:
- 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Hammer-driven anchors and fasteners are not permitted.
  - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction.
  - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction.
10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
  - b. Comply with MFMA-4.
  - c. Channel Material: Use galvanized steel.
  - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

2.02 MANUFACTURERS (LISTED IN ALPHABETICALLY ORDER ONLY AND NOT NECESSARY BY PREFERENCE)

- A. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- B. Threaded Rod Company: [www.threadedrod.com](http://www.threadedrod.com).
- C. Or Approved Equal.
- D. Substitutions: See Section 01 66 00 - Product Requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.03 SUPPORTS

- A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be springable wrought steel. Rings shall be bolted to or interlocked with the suspension rod socket.
- B. Pipe racks for groups of parallel conduits shall be constructed of galvanized structural steel preformed channels of length as required, suspended on threaded rods and secured thereto with nuts above and below the cross bar.
- C. Factory made pipe straps shall be one hole malleable iron or two hole galvanized clamps.
- D. Supporting rods shall be at least 3/8" diameter and channel shall be at least 3/4" deep. Supporting hardware shall be galvanized steel.

2.04 MATERIALS

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
  - 1. Sheet Metal Screws: Steel
  - 2. Machine Screws Bolts, Nuts and Washers: Steel
  - 3. Precast Inserts: Suitable for the purpose.
  - 4. Anchor Bolts, expansion type (stainless steel).
    - a. Phillips Red-Head
    - b. Hilti Kwik-Bolt.
    - c. WEJ-IT.
  - 5. Cast-in-Place Anchors: Suitable for the purpose (hot-dip galvanized except cadmium plated in dry locations)
  - 6. Beam Clamps: Steel.
- D. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Steel Structural Elements: Use beam clamps or welded fasteners.
- F. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
- G. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
- H. Solid Masonry Walls: Use expansion anchors or preset inserts.
- I. Sheet Metal: Use sheet metal screws.
- J. Wood Elements: Use wood screws.
- K. Fastener Types:
  - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
  - 5. Other Types: As required.
  - 6. Manufacturers:
    - a. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
    - b. Or approved equal.
- L. Formed Steel Channel as indicated on drawings.
- M. Steel Spring Clips: As indicated on drawings

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. General

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Install products in accordance with manufacturer's instructions.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
  4. In Correctional Facilities, provide and install detention metal fasteners in inmate accessible areas in accordance with Section 11 19 23.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
1. Concrete – Precast inserts, cast-place anchors, or expansion type anchor bolts.
    - a. When installing drilled-in anchors in non-prestresses reinforced concrete, avoid the reinforcing bars.
    - b. When installing drilled-in anchors into prestressed concrete (Pre- or Post-tensioned) locate tendons by using a non-destructive method prior to installation. Maintain a minimum clearance of one-inch between the reinforcement and the drilled-in anchor.
  2. Sheet Metal – Sheet metal screws or machine bolts, nuts, and washers.
  3. Structural Steel Members – Beam clamps, machine screws, bolts, nuts, and washers.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

I. Conduit Support and Attachment

1. In damp or wet locations, space conduit support directly from concrete or metal structure out at least  $\frac{1}{4}$  inch using straps with spacers or, if three (3) or more conduits are located in a parallel run, they shall be spaced out from the wall approximately  $\frac{5}{8}$  inch to 1 inch by means of a channel.
2. Runs of individual conduit suspended from the floor or ceiling shall be supported with pipe hangers. Where three (3) or more conduits are suspended from the floor or ceiling, suitable racks shall be constructed from channel material with suitable fittings.
3. Space supporting points no greater than required by CEC.

J. Sleeves

1. Set sleeves in position in formwork. Provide reinforcing around sleeves.
2. Extend sleeves through floors 1 inch above finished floor levels. Caulk sleeves full depth and provide floor plate.
3. Where raceway penetrated floor, ceiling, or wall. Close off space between pipe or duct and adjacent work with fire stopping insulation and caulk seal.

K. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

L. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

M. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

N. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

O. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

P. Secure fasteners in accordance with manufacturer's recommended torque settings.

Q. Remove temporary supports.

R. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
 SACRAMENTO, CALIFORNIA  
 100% CONSTRUCTION DOCUMENTS  
 4 JANUARY 2024

3.03 FIELD QUALITY CONTROL

- A. See Section 01 45 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.
  - 1. Obtain permission from the Architect and the Structural Engineer before drilling or cutting structural members.
- E. All expansion anchors shall have 50 percent of the bolts (alternate bolts in any group arrangement) proof tested in tension and certified by a recognized testing agency at the values indicated in the following table, except where shown otherwise in the Contract Documents. If there are any failures, the immediately adjacent bolts must then also be tested. Anchor capacities shall not exceed 80 percent of the values in the published ICBO report.

| ANCHOR CAPACITY<br>(3,000 PSI MINIMUM STONE AGGREGATE CONCRETE) |             |             |             |             |        |                 |        |
|---|-------------|-------------|-------------|-------------|--------|-----------------|--------|
|   | 1/2<br>inch | 5/8<br>inch | 3/4<br>inch | 7/8<br>inch | 1 inch | 1-1/4<br>inches | UNITS  |
| IN TENSION  | 680         | 960         | 1,360       | 1,900       | 2,700  | 3,600           | LBS    |
| IN SHEAR  | 1,170       | 1,680       | 2,420       | 3,500       | 5,020  | 6,700           | LBS    |
| TYPE OF TEST:   |             |             |             |             |        |                 |        |
| DIRECT PULL-TENSION, LBS.                                       | 1,360       | 1,920       | 2,720       | 3,800       | 5,400  | 7,200           | LBS    |
| MINIMUM EMBEDMENT   | 3           | 3-3/4       | 4-1/2       | 5-1/4       | 6      | 7-1/2           | INCHES |

END OF SECTION 26 05 29



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 33.13  
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: Provide rigid metallic conduit, rigid non-metallic conduit, intermediate metal conduit, flexible metal conduit, electrical metallic tubing, surface metal and/or non-metallic raceways, cable tray and wireways as shown on the drawings and as described in the specifications.

1.02 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Reinforced thermosetting resin conduit (RTRC).
- I. Conduit, fittings and conduit bodies.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 53 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 26 05 00 – Common Work Results for Electrical.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.16 - Boxes for Electrical Systems.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- H. Section 26 05 53 - Identification for Electrical Systems: Identification of products and requirements.
- I. Section 31 23 33 - Trenching: Excavating, bedding, and backfilling.
- J. The requirements of the kitchen equipment consultant plans and specifications.

1.04 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A) 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- M. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.
- N. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2021).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- O. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2020).
- P. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings 2015 (Reaffirmed 2021).
- Q. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- R. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- S. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- T. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- U. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- V. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- W. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- X. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- Y. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- Z. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
- AA. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.
- BB. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.
- CC. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.
- DD. UL 2515 - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

EE. UL 2515A - Standard for Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Electrical Engineer of Record of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, fittings, and conduit bodies.
- F. Project Record Documents: Accurately record actual routing of conduits larger than 1 1/4 inches.

1.07 QUALITY ASSURANCE

- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on drawings.
- B. Verify conduit routing and termination locations of conduits prior to rough in.
- C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring systems.

1.10 RATED WALLS AND CEILINGS

- A. Inspect architectural plans for locations and fire ratings for all walls, ceilings, and floors. Install materials as required to maintain the fire integrity of the rated assemblies.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit where emerging from underground.
  - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows or PVC-coated galvanized steel rigid metal conduit elbows for bends.
  - 6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- D. Embedded Within Concrete:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
  2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
  3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or PVC-coated galvanized steel rigid metal conduit where emerging from concrete.
  5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet in warehouse areas.
    - c. In Correctional Facilities, Galvanized rigid steel only for inmate accessible areas. Locations shall be verified with the architect.
- K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit.
- N. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
  - 1. Maximum Length: 6 feet.
- P. Flexible Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit (FMC).
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
  - 3. Maximum Length: 6 feet unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
    - c. Engine generators.
- Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.
- R. Freezer and Refrigeration Rooms
  - 1. Galvanized rigid steel conduit.
  - 2. Use sealing fittings on refrigeration and freezer room conduit runs in accordance with CEC 300-7(a).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Electrical Service Conduits: See Section 26 21 00 for additional requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
- E. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2-inch trade size.
  - 2. Branch Circuit Homeruns: 3/4-inch trade size.
  - 3. Control Circuits: 1/2-inch trade size.
  - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  - 5. Underground, Interior: 1 inch (27 mm) trade size.
  - 6. Underground, Exterior: 1-inch trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
  - 1. Allied Tube & Conduit, a division of Atkore International : [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  - 2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
  - 3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
  - 4. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  - 5. Wheatland Tube, a division of Zekelman Industries: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  - 6. Or approved equal.
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Fittings:

1. Manufacturers:

- a. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
  - b. Appleton.
  - c. Crouse-Hinds.
  - d. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - e. Or approved equal.
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
- a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Where an expansion type fitting is not required, use a coupling or "Erickson" type coupling as appropriate. Threadless set screw and compression (gland) type fittings are not permitted.
6. At building expansion joints, use expansion type fittings.
7. Make connections to NEMA 12 boxes with a threaded hub.

D. Locknuts

1. Hardened Steel or malleable iron construction, electro zinc plated, capable of insuring positive bond to enclosure.
  - a. Non-bonding: T & B Series 142 or approved equal.
  - b. Bonding: T & B Series 107 or approved equal.

E. Bushings

1. Insulated: T & B Series 223 or approved equal.
2. Insulated Metallic Bushing: T & B Series 1223 or approved equal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Insulated Grounding and Bonding Bushing: T & B Series 3871 or approved equal.

F. Couplings

1. Non-metallic Conduit Coupling: By non-metallic conduit manufacturer for the application.
2. Threaded Rigid Metal Conduit Couplings: By conduit manufacturer for the application.
3. Threadless Coupling: "Erickson" Type Y & B Series 676 or approved equal.
4. Expansion Type: Permit  $\frac{3}{4}$  inch movement any direction.
  - a. Exposed: Weatherproof with external bonding jumper.
  - b. Embedded: Watertight with internal bonding jumper.

G. Connectors

1. Non-Metallic Conduit Connector: By conduit manufacturer for the application.
2. Threaded Hubs: Electro zinc coated with nylon insulated throat and oil/moisture resistant recessed sealing ring, raintight.
  - a. Non-bonding: T & B Series 371 or approved equal.
  - b. Bonding: T & B Series 371 with 107 series bonding locknut or approved equals.

- H. Nipple: "Chase" Type, insulated: T & B Series 5263 or approved equal.

- I. Sealing Gaskets: Oil and moisture resistant rubber bonded to metallic retainer.

1. With rigid conduit – T & B Series 5303 or approved equal.
2. Fittings not specifically listed but required shall be of similar style and quality.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
  3. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  4. Wheatland Tube, a division of Zekelman Industries: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  5. Or approved equal.
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
1. Manufacturers:
    - a. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - c. Or approved equal.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
  3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
  4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
- D. Conduit Size: Comply with NFPA 70.
1. Exposed: Use rigid steel conduit or intermediate metal conduit for installation up to 8 feet.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  4. Or approved equal.
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction.
- E. Connectors and Fittings: NEMA FB 1.
1. Flexible metal conduit connector – Insulated throat, suitable as grounding means: T & B Series 3115.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
1. AFC Cable Systems, Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  4. Or approved equal.
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction with PVC jacket.
- E. Fittings: NEMA FB 1.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
1. Allied Tube & Conduit: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  2. Nucor Tubular Products: [www.nucortubular/#sle](http://www.nucortubular/#sle).
  3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
  4. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  5. Beck Manufacturing, Inc: [www.beckmfg.com](http://www.beckmfg.com).
  6. Wheatland Tube Company: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

7. Or Equal.
  8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
1. Manufacturers:
    - a. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - b. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - c. Or approved equal.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  4. Connectors and Couplings: Use compression/gland type.
    - a. Do not use indenter type connectors and couplings.
    - b. Do not use set-screw type connectors and couplings.
    - c. EMT Coupling: Raintight T & B Series 5220 or approved equal.
    - d. EMT to Rigid Metal Conduit Connector, Raintight: T & B Series 531 or approved equal.
  5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
  6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.
- D. Description: ANSI C80.3; galvanized tubing.
- E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.



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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. Cantex Inc: [www.cantexinc.com/#sle](http://www.cantexinc.com/#sle).
2. JM Eagle: [www.jmeagle.com/#sle](http://www.jmeagle.com/#sle).
3. Or approved equal.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Manufacturers:

1. Champion Fiberglass, Inc: [www.championfiberglass.com/#sle](http://www.championfiberglass.com/#sle).
2. FRE Composites: [www.frecompositesinc.com/#sle](http://www.frecompositesinc.com/#sle).
3. United Fiberglass of America, Inc: [www.unitedfiberglass.com/#sle](http://www.unitedfiberglass.com/#sle).
4. Or approved equal.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Applications:

1. Above Ground, Not Subject to Physical Damage: Use aboveground (AG), SW (Standard Wall), HW (Heavy Wall), or XW (Extra Heavy Wall) RTRC.
2. Above Ground, Subject to Physical Damage: Use aboveground (AG), XW (Extra Heavy Wall) RTRC.
3. Underground, Direct-Buried: Use belowground (BG), DB (direct-burial) RTRC or aboveground (AG) RTRC.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Underground, Embedded in Concrete: Use belowground (BG), EB (encased-burial) RTRC, belowground (BG), DB (direct-burial) RTRC, or aboveground (AG) RTRC.
  5. Do not use RTRC in hazardous/classified locations.
- C. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
1. Aboveground (AG) RTRC: Comply with NEMA TC 14.AG and list and label as complying with UL 2515.
  2. Aboveground (AG), XW (Extra Heavy Wall) RTRC: Comply with NEMA TC 14.XW and list and label as complying with UL 2515A.
  3. Belowground (BG) RTRC: Comply with NEMA TC 14.BG and list and label as complying with UL 2420.
- D. Supports: As recommended by manufacturer.
- E. Fittings: Same type and manufacturer as conduit to be connected.
1. Cement-Tight Joints: Use bonded coupling or bell and spigot.
  2. Cement-Tight and Watertight Joints: Use adhesive and manufacturer's standard gaskets.

2.10 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Internal to fittings
    - a. Approved by manufacturer for application.
  2. Manufacturer
    - a. Crouse-Hinds Chico A-P and Chico X fiber.
    - b. O.Z. Gedney.
    - c. Or approved equal.
- G. Sealing Systems for Concrete Penetrations:
1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
  2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
1. Products:
    - a. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - b. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - c. Or approved equal.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
1. Products:
    - a. Quickflash Weatherproofing Products, Inc: [www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
    - b. Or approved equal.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:

- a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
- b. Or approved equal.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

1. Products:

- a. Advance Products & Systems, LLC; Duct Bank Spacers: [www.apsonline.com/#sle](http://www.apsonline.com/#sle).
- b. Or approved equal.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

1. Products:

- a. Advance Products & Systems, LLC; Bore Spacers: [www.apsonline.com/#sle](http://www.apsonline.com/#sle).
- b. Or approved equal.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Verify routing and termination locations of conduit prior to rough-in.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- I. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route exposed conduits:
    - a. Across floors.
    - b. Across roofs.

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Across top of parapet walls.
  - d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  7. Arrange conduit to maintain adequate headroom, clearances, and access.
  8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
  9. Arrange conduit to provide no more than 150 feet between pull points.
  10. Route conduits above water and drain piping where possible.
  11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  14. Group parallel conduits in same area on common rack.
- J. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
  2. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
  3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  5. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
  9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
  10. Use of spring steel conduit clips for support of conduits is not permitted.
    - a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
  11. Use of wire for support of conduits is not permitted.
    - a. For securing conduits to studs in hollow stud walls.
    - b. For suspending conduits supported by spring steel conduit clips, where specifically indicated or permitted.
  12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
  7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
  8. Secure joints and connections to provide mechanical strength and electrical continuity.
- L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
  6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
  8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
  9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

M. Underground Installation:

1. Provide trenching and backfilling; see Section 31 23 16 and Section 31 23 23.
2. Minimum Cover, Unless Otherwise Indicated or Required:
  - a. Underground, Exterior: 18 inches.
  - b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.

N. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
2. Minimum Conduit Spacing: As indicated on drawings.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

O. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

Q. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
    - a. Where conduits enter building from outside.
    - b. Where service conduits enter building from underground distribution system.
    - c. Where conduits enter building from underground.
    - d. Where conduits may transport moisture to contact live parts.
  2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
    - a. Where conduits pass from outdoors into conditioned interior spaces.
    - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- R. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- S. Provide grounding and bonding; see Section 26 05 26.
- T. Identify conduits; see Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.04 EMPTY CONDUITS

- A. Certain conduits will have no conductors pulled in as a part of this contract. Identify with tags at each end of the origin and destination of each such empty conduits. Provide a permanent cap over each end of each empty conduit. Provide a nylon pull wire in each empty conduit, tie off at both ends.

3.05 TESTING AND INSPECTION

- A. So not cover up conduit work until inspected. Notify the Owner's Representative at least 3 days before desired inspection date.

3.06 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.07 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
- B. All conduits shall be run concealed in walls and/or ceiling. Where conduits can not be run concealed in wall and/or ceiling space, the Contractor shall coordinate with the architectural and structural plans and the Architect for installing and routing of exposed conduits.

3.08 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

END OF SECTION 26 05 33.13

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 33.16  
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Scope: Provide boxes, pull boxes, racks, and enclosures as shown on drawings or as required by code(s).
- B. Section Includes:
  - 1. Boxes and enclosures for integrated power, data, and audio/video.
  - 2. Boxes for hazardous (classified) locations.
  - 3. Floor boxes.
  - 4. Underground boxes/enclosures.
  - 5. Accessories.
  - 6. Wall and ceiling outlet boxes.
  - 7. Floor boxes.
  - 8. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 53 - Cast-in-Place Concrete.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 27 26 - Wiring Devices:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Wall plates.
  2. Floor box service fittings.
  3. Poke-through assemblies.
  4. Access floor boxes.
  5. Additional requirements for locating boxes for wiring devices.
- H. Section 26 28 13 - Fuses: Spare fuse cabinets.
- I. The requirements of the kitchen equipment consultant plans and specifications.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- L. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- M. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- N. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.
- O. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
  1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Samples:

1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
  5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
  6. Use suitable concrete type boxes where flush-mounted in concrete.
  7. Use suitable masonry type boxes where flush-mounted in masonry walls.
  8. Use raised covers suitable for the type of wall construction and device configuration where required.
  9. Use shallow boxes where required by the type of wall construction.
  10. Do not use "through-wall" boxes designed for access from both sides of wall.
  11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Minimum Box Size, Unless Otherwise Indicated:
  - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
  - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
17. Wall Plates: Comply with Section 26 27 26.
18. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
  - c. Hubbell Incorporated; RACO Products: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
  - d. O-Z/Gedney, a brand of Emerson Electric Co : [www.emerson.com/#sle](http://www.emerson.com/#sle).
  - e. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
  - f. Or equal.
  - g. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. NEMA 250 Environment Type, Unless Otherwise Indicated:
  - a. Indoor Clean, Dry Locations: Type 1, painted steel.
  - b. Outdoor Locations: Type 3R, painted steel.
  - c. Kitchens and food prep. Locations: Type 4X, stainless steel, unpainted.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
  - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
  - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
  - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
  - b. Back Panels: Painted steel, removable.
  - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
  - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com/#sle](http://www.hoffmanonline.com/#sle).
  - c. Hubbell Incorporated; Wiegmann Products: [www.hubbell-wiegmann.com/#sle](http://www.hubbell-wiegmann.com/#sle).
  - d. Or equal.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

1. Manufacturers:

- a. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
- b. Or approved equal.
- c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

1. Manufacturers:

- a. Appleton, a brand of Emerson Electric Co: [www.emerson.com/#sle](http://www.emerson.com/#sle).
- b. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
- c. Hubbell Incorporated; Killark Products: [www.hubbell-killark.com/#sle](http://www.hubbell-killark.com/#sle).
- d. Or approved equal.
- e. Substitutions: See Section 01 60 00 - Product Requirements.

F. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
  - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
  - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
  - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
  - a. Manufacturers:
    - 1) Hubbell Incorporated; Quazite  
Products: [www.hubbellpowersystems.com/#sle](http://www.hubbellpowersystems.com/#sle).
    - 2) MacLean Highline: [www.macleanhighline.com/#sle](http://www.macleanhighline.com/#sle).
    - 3) Oldcastle Precast, Inc: [www.oldcastleprecast.com/#sle](http://www.oldcastleprecast.com/#sle).
    - 4) Or equal.
    - 5) Substitutions: See Section 01 60 00 - Product Requirements.
  - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
  - c. Product(s):
    - 1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
      - (a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
  - (a) 11 by 18 by 12 inches nominal; Model CHA111812.
- 3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
  - (a) 30 by 48 by 18 inches nominal; Model CVA304818.
- 4) Or approved equal.

2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
  1. Manufacturers:
    - a. Quickflash Weatherproofing Products, Inc: [www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
    - b. Or approved equal.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MANUFACTURERS

- A. Appleton Electric: [www.appletonelec.com](http://www.appletonelec.com).
- B. Arc-Co./Division of Arcade Technology: [www.arc-co.com](http://www.arc-co.com).
- C. Unity Manufacturing: [www.unitymfg.com](http://www.unitymfg.com).
- D. Or approved equal.
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.04 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
  1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  2. Concrete Ceiling Boxes: Concrete type.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.05 FLOOR BOXES

- A. Floor Boxes: NEMA OS 1, fully adjustable, 1-1/2 inches deep.
- B. Material: Cast metal.
- C. Shape: Round.
- D. Service Fittings: As specified in Section 26 2726.

2.06 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures: As specified in Section 26 2716.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
  - 1. Material: Galvanized cast iron.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
  - 1. Material: Galvanized cast iron.
  - 2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
  - 3. Cover Legend: "ELECTRIC".

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Boxes are indicated in approximate locations only on the drawings unless specifically dimensioned. Verify all box locations prior to rough-in.
- C. Verify that mounting surfaces are ready to receive boxes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Verify that conditions are satisfactory for installation prior to starting work.
- E. Verify locations of floor boxes and outlets prior to rough-in.
- F. Verify locations of all boxes required for kitchen equipment with kitchen consultant plans and specifications.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
  - 4. Locate boxes so that wall plates do not span different building finishes.
  - 5. Locate boxes so that wall plates do not cross masonry joints.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
  - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.
  - b. Within joists in areas with no ceiling.
  - c. Electrical rooms.
  - d. Mechanical equipment rooms.
- I. Box Supports:
  1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide required seismic controls in accordance with Section 26 05 48.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- P. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
  2. Flush-mount enclosures located in concrete or paved areas.
  3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Provide cast-in-place concrete collar constructed in accordance with Section 03 30 00, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
  5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- S. Close unused box openings.
- T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- U. Provide grounding and bonding in accordance with Section 26 05 26.
- V. Identify boxes in accordance with Section 26 05 53.
- W. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- X. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 72.
- Y. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.
- Z. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- AA. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- BB. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- CC. Maintain headroom and present neat mechanical appearance.
- DD. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- EE. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- FF. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- GG. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- HH. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- II. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- JJ. Use flush mounting outlet box in finished areas.
- KK. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- LL. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in fire-rated and acoustic rated walls.
- MM. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- NN. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- OO. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- PP. Use adjustable steel channel fasteners for hung ceiling outlet box.
- QQ. Do not fasten boxes to ceiling support wires.
- RR. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- SS. Use gang box where more than one device is mounted together. Do not use sectional box.
- TT. Use gang box with plaster ring for single device outlets.
- UU. Use cast outlet box in exterior locations exposed to the weather and wet locations.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

VV. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

WW. Set floor boxes level.

XX. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 05 33.16

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
  - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Anchoring and seismic restraint systems.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 53 - Cast-in-Place Concrete.
- B. Section 26 05 00 - Common Work Results for Electrical.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements
  - 1. Provide the work in compliance with CCR Title 24, Part 2, State Chapters, Drawings, and calculations to be stamped and signed by a California licensed structural engineer.
  - 2. Provide seismic restraints for the listed materials and equipment. The attachments shall resist forces to the center of gravity of the component. Criteria shall be the operating weight of the item times 0.5g for horizontal force to be applied in any direction. Wall-mounted or suspended components shall in addition, resist a downward force of 200 pounds minimum added to the operating weight of the component.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.04 DEFINITIONS

- A. Electrical Component: Where referenced in this section in regard to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.05 REFERENCE STANDARDS

- A. ASTM E2265-2003 – Standard Terminology for Anchors and Fasteners in Concrete and Masonry.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- D. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- F. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- H. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2020).
- J. MFMA-4 - Metal Framing Standards Publication 2004.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

M. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
5. Seismic Controls:
  - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
6. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.07 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
  2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
  2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
  2. Identify mounting conditions required for equipment seismic qualification.
  3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
  4. Indicate proposed arrangement of distributed system trapeze support groupings.
  5. Indicate proposed locations for distributed system flexible fittings and/or connections.
  6. Indicate locations of seismic separations where applicable.
  7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- F. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Component operating weight and center of gravity.
- b. Component elevation in the building in relation to the roof elevation (z/h).
- c. Component importance factor ( $I_p$ ).
- d. For distributed systems, component materials and connection methods.
- e. Component amplification factor ( $a_p$ ) and component response modification factor ( $R_p$ ), determined in accordance with ASCE 7 tables.
- f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).

2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

- G. Certification for seismically qualified equipment; identify basis for certification.
- H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.
- I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- J. Evidence of qualifications for seismic controls designer.
- K. Evidence of qualifications for manufacturer.
- L. Manufacturer's detailed field testing and inspection procedures.
- M. Field quality control test reports.

1.08 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in California and with minimum five years experience designing seismic restraints for nonstructural components.
  - 1. Designer may be employed by the manufacturer of the seismic restraint products.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
  - 1. Select vibration isolators to provide required static deflection.
  - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
  - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
  - 4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
  - 5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation:

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SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Transformers:

- a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
- b. Floor-Mounted Transformers, Nonseismic Applications: Use resilient material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
- c. Floor-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts or seismic type restrained spring isolators.
- d. Suspended Transformers, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
- e. Suspended Transformers, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
- f. Wall-Mounted Transformers, Nonseismic Applications: Use resilient material isolator mounts.
- g. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
- h. Minimum Static Deflection:
  - 1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
  - 2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.

2. Engine Generators:

- a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
- b. Nonseismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Nonseismic Applications, Isolators Located Below Sub-Base Fuel Tank: Use restrained spring isolators.
  - d. Seismic Applications: Use seismic type restrained spring isolators.
  - e. Provide vibration-isolated concrete inertia bases where indicated.
  - f. Minimum Static Deflection:
    - 1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.
    - 2) Generators Mounted at Above-Grade Levels: 2 inch deflection unless otherwise indicated.
- E. Conduit Isolation:
- 1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
    - a. Minimum Length: 3 feet unless otherwise indicated.
  - 2. Vibration Isolators:
    - a. Provide vibration isolators for conduit supports:
      - 1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.
      - 2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
    - b. Minimum Static Deflection:
      - 1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
      - 2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
    - c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
- e. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

## 2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: ICC (IBC)/ASCE 7.
- C. Component Importance Factor ( $I_p$ ): Electrical components are to be assigned a component importance factor ( $I_p$ ) of 1.0 for RC II and III unless otherwise indicated.
- D. Seismic Qualification of Equipment:
  - 1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor ( $I_p$ ) of 1.5, certifying that equipment will remain operable following a design level earthquake.
  - 2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
  - 3. Notify LP Consulting Engineers, Inc. and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
  - 4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.
- E. Seismic Restraints:
  - 1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
  - a. ASHRAE (HVACA).
  - b. FEMA 413.
  - c. FEMA E-74.
  - d. SMACNA (SRM).
3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
4. Seismic Type Vibration Isolators:
  - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
5. External Seismic Snubber Assemblies:
  - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
  - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
6. Seismic Restraint Systems:
  - a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
  - b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
  - c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
- e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
- f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.
- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:

- 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
- 3. Do not use power-actuated fasteners.
- 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
  - a. Increase size of pad as required to comply with anchor requirements.
  - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
3. Comply with minimum clearance requirements between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

H. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
  - a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
  - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
  - c. Design displacements at seismic separations.
  - d. Anticipated drifts between floors.
2. Include provisions to prevent interruption of utility service due to seismic displacements.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:

1. Vibration-Isolated Equipment Support Bases:



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
  - d. Korfund Dynamics Corp.
  - e. Amber-Booth Co.
  - f. Consolidated Kinetics.
2. Substitutions: See Section 01 60 00 - Product Requirements.
  3. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:

1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:

1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

2.04 VIBRATION ISOLATORS

A. Manufacturers:

1. Vibration Isolators:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
  - d. Korfund Dynamics Corp.
  - e. Amber-Booth Co.
  - f. Consolidated Kinetics.
  - g. Or approved equal.
2. Substitutions: See Section 01 60 00 - Product Requirements.
  3. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
  2. Spring Elements for Spring Isolators:
    - a. Color code or otherwise identify springs to indicate load capacity.
    - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
    - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
    - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
    - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
    - f. Selected to function without undue stress or overloading.
  3. Seismic Snubbing Elements for Seismic Isolators:
    - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:

- a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
- b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
- c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

2. Resilient Material Isolator Mounts, Nonseismic:

- a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.

3. Open (Unhoused) Spring Isolators:

- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
- b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
- c. Furnished with integral leveling device for positioning and securing supported equipment.

4. Housed Spring Isolators:

- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
- b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
- c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
  - b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
  - d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
- a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

D. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
  - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
  - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
  - d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

1. External Seismic Snubber Assemblies:

- a. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
- b. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
- c. Vibration Eliminator Company, Inc: [www.vec-co-nyc.com/#sle](http://www.vec-co-nyc.com/#sle).
- d. Korfund Dynamics Corp.
- e. Amber-Booth Co.
- f. Consolidated Kinetics.
- g. Or approved equal.

2. Substitutions: See Section 01 60 00 - Product Requirements.

3. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

- B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.06 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:

1. Seismic Restraint Systems:

- a. AFCON, a brand of Anvil International: [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
- b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- c. Kinetics Noise Control, Inc: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
- d. Mason Industries: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
- e. Or approved equal.

2. Substitutions: See Section 01 60 00 - Product Requirements.

3. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:

1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or LP Consulting Engineers, Inc. in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
  - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Seismic special inspections include, but are not limited to:
  - 1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
  - 2. Anchorage of electric equipment for emergency and standby power systems for Seismic Design Categories C, D, E, and F; periodic inspection.
  - 3. Anchorage of electrical equipment other than for emergency and standby power systems for Seismic Design Categories E and F; periodic inspection.
  - 4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Verification of required clearances between electrical equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.
- D. Seismic special inspections include, but are not limited to:
1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
  2. Anchorage of electric equipment for emergency and standby power systems for Seismic Design Categories C, D, E, and F; periodic inspection.
  3. Anchorage of electrical equipment other than for emergency and standby power systems for Seismic Design Categories E and F; periodic inspection.
  4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
- E. Prior to starting work, to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- F. Special Inspection Agency services do not relieve from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

F. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
  - a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
  - a. Position equipment at operating height; provide temporary blocking as required.
  - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
  - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
  - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
  - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

G. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
  - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
  - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
  - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
  - a. Size in accordance with seismic design to meet anchor requirements.
  - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
  - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
  - b. Install restraints within permissible angles in accordance with seismic design.
  - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
  - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
  - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- D. Vibration Isolation Systems:
  - 1. Verify isolator static deflections.
  - 2. Verify required clearance beneath vibration-isolated equipment support bases.
  - 3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- E. Seismic Controls:
  - 1. Verify snubbing element air gaps.
- F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05 ATTACHMENTS

- A. Statement of special inspections.

END OF SECTION 26 05 48

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 53  
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.
- H. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 91 23 - Interior Painting.
- C. Section 26 05 00 – Common Work Results for Electrical.
- D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:  
Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- E. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. NFPA 70E - Standard for Electrical Safety in the Workplace 2024.
- E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Samples:
  - 1. Identification Nameplates: One of each type and color specified.
  - 2. Warning Signs and Labels: One of each type and legend specified.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Conform to requirements of NFPA 70.
- C. Furnish products listed and classified by UL as suitable for the purpose specified and shown.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Switchboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use identification nameplate to identify main overcurrent protective device.
      - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - b. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
  - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
- c. Transformers:
- 1) Identify kVA rating.
  - 2) Identify voltage and phase for primary and secondary.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
  - 4) Identify load(s) served. Include location when not within sight of equipment.
- d. Enclosed switches, circuit breakers, and motor controllers:
- 1) Identify voltage and phase.
  - 2) Identify power source and circuit number. Include location when not within sight of equipment.
  - 3) Identify load(s) served. Include location when not within sight of equipment.
- e. Time Switches:
- 1) Identify load(s) served and associated circuits controlled. Include location.
- f. Enclosed Contactors:
- 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
  - 4) Identify coil voltage.
  - 5) Identify load(s) and associated circuits controlled. Include location.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- g. Centralized Emergency Lighting Inverters:
    - 1) Identify input and output voltage and phase.
    - 2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
    - 3) Identify load(s) served. Include location.
  - h. Transfer Switches:
    - 1) Identify voltage and phase.
    - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
    - 3) Identify load(s) served. Include location when not within sight of equipment.
    - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
  - i. Electricity Meters:
    - 1) Identify load(s) metered.
2. Service Equipment:
- a. Use identification nameplate to identify each service disconnecting means.
  - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
- a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
  - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
  - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
12. Available Fault Current Documentation: Comply with Section 26 05 73. Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
  - b. Industrial control panels.
  - c. Motor control centers.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Elevator control panels.
  - e. Industrial machinery.
13. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- C. Identification for Conductors and Cables:
- 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
  - 2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
  - 3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  - 4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Within boxes when more than one circuit is present.
  - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
6. Use underground warning tape to identify direct buried cables.
- D. Identification for Raceways:
- 1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
  - 2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
    - a. Maximum Intervals: 20 feet.
    - b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      - 1) Field-Painting: Comply with Section 09 91 23 and 09 91 13.
      - 2) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
      - 3) Other Owner required color coding systems.
  - 3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
  - 4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
  - 5. Use underground warning tape to identify underground raceways.
  - 6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.
- E. Identification for Boxes:
- 1. Use voltage markers to identify highest voltage present.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Use voltage markers or color coded boxes to identify systems other than normal power system.
  3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.. Install on back side of box cover.
    - a. For exposed boxes in public areas, use only identification labels.
  4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
  2. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
  3. Use identification label to identify fire alarm system devices.
    - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
  4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
  5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
  6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- H. Buried Electrical Lines: Underground warning tapes.
- I. Communication Cabinets: Nameplates.
- J. Conduit: Conduit markers.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

K. Control Device Station: Labels.

L. Electrical Distribution and Control Equipment Enclosures: Nameplates.

## 2.02 MANUFACTURERS

A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).

B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

C. HellermannTyton: [www.hellermanntyton.com](http://www.hellermanntyton.com).

D. E-Z Code by T&B.

E. Pan-Code by Panduit.

F. Or approved equal.

G. Substitutions: See Section 01 6000 - Product Requirements.

## 2.03 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:

a. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).

b. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).

c. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).

d. Or approved equal.

e. Substitutions: See Section 01 60 00 - Product Requirements.

2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.

b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
    - a. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
    - b. Brother International Corporation: [www.brother-usa.com/#sle](http://www.brother-usa.com/#sle).
    - c. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
    - d. Or approved equal.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    - a. Use only for indoor locations.
  3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend:
    - a. System designation where applicable:
      - 1) Emergency Power System: Identify with text "EMERGENCY".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height:
    - a. System Designation: 1/2 inch.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Equipment Designation: 1/4 inch.
  - c. Other Information: 1/8 inch.
  - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
- a. Normal Power System: White text on black background.
    - 1) 480Y/277 V, 3 Phase Equipment: White text on orange background.
    - 2) 208Y/120 V, 3 Phase Equipment: White text on black background.
  - b. Emergency Power System: White text on red background.
- D. Format for General Information and Operating Instructions:
- 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/4 inch.
  - 5. Color: Black text on white background unless otherwise indicated.
    - a. Exceptions:
      - 1) Provide white text on red background for general information or operational instructions for emergency systems.
      - 2) Provide white text on red background for general information or operational instructions for fire alarm systems.
      - 3) Provide white text on black background for all other systems, unless noted otherwise.
- E. Format for Caution and Warning Messages:
- 1. Minimum Size: 2 inches by 4 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 1/2 inch.
  5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Load controlled or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- H. Manufacturers:
1. Kolbi Pipe Marker Co.; Model: [www.kolbipipemarkers.com](http://www.kolbipipemarkers.com).
  2. Seton Identification Product; Model: [www.seton.com](http://www.seton.com).
  3. Or approved equal.
- I. Nameplates: Engraved three-layer laminated plastic, white letters on black background, unless noted otherwise on drawings or specifications.
- J. Locations:
1. Each electrical distribution and control equipment enclosure.
  2. Communication cabinets.
- K. Letter Size:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Use 1/8 inch letters for identifying individual equipment and loads.
  2. Use 1/4 inch letters for identifying grouped equipment and loads.
- L. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations.

#### 2.04 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
2. Seton Identification Products: [www.seton.com](http://www.seton.com).
3. HellermannTyton: [www.hellermannntyton.com/#sle](http://www.hellermannntyton.com/#sle).
4. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
5. Or approved equal.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, or plastic sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Description: Vinyl cloth type self-adhesive wire markers.

I. Description: Cloth type wire markers.

J. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

K. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.05 VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
4. HellermannTyton: [www.hellermanntyton.com](http://www.hellermanntyton.com).
5. Or approved equal.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
  - a. Emergency Power System: Text "EMERGENCY".
  - b. Other Systems: Type of service.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. Color: Black text on orange background unless otherwise indicated.
- G. Location: Furnish markers for each conduit longer than 6 feet.
- H. Spacing: 20 feet on center.
- I. Color:
  - 1. Fire Alarm System: Red.

#### 2.06 UNDERGROUND WARNING TAPE

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. HellermannTyton: [www.hellermanntyton.com](http://www.hellermanntyton.com).
  - 5. Or approve equal.
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

#### 2.07 FLOOR MARKING TAPE

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  5. Or approved equal..
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

## 2.08 WARNING SIGNS AND LABELS

### A. Manufacturers:

1. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  2. Clarion Safety Systems, LLC: [www.clarionsafety.com/#sle](http://www.clarionsafety.com/#sle).
  3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  5. Or approved equal.
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

### C. Warning Signs:

1. Materials:
  - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
  - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

### D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Do not use labels designed to be completed using handwritten text.
  2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- E. Floor Signs:
1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlamine; removable.
  2. Minimum Size: 17-inch diameter unless otherwise indicated.
- F. Description: 3 inch wide polyethylene tape, detectable type colored red with suitable warning legend describing buried electrical lines.
- G. Description: 4 inch wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  1. Surface-Mounted Equipment: Enclosure front.
  2. Flush-Mounted Equipment: Enclosure front.
  3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  4. Elevated Equipment: Legible from the floor or working platform.
  5. Branch Devices: Adjacent to device.
  6. Interior Components: Legible from the point of access.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

7. Conduits: Legible from the floor.
  8. Boxes: Outside face of cover.
  9. Conductors and Cables: Legible from the point of access.
  10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 05 83  
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 33.13 - Conduit for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 27 26 - Wiring Devices.
- F. Section 26 28 16.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

## 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

## 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Comply with NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
  - 4. Product: As noted on drawings or as required for the application.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Disconnect Switches: As described and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 33.13.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 33.16.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

## 2.02 EQUIPMENT CONNECTIONS

### A. Connection Types and Ratings::

1. Electrical Connection: Flexible conduit, metallic or liquid tight flexible conduit as required by the application.
2. Electrical Connection: Cord and plug (Verify NEMA configuration and rating with equipment installer at jobsite).
3. Provide field-installed disconnect switch.
4. Voltage: Verify with equipment nameplate.
5. Load rating: Verify with equipment nameplate.
6. FLA: Verify with equipment nameplate.
7. WSA: Verify with equipment nameplate.
8. Branch Circuit: Verify with equipment nameplate.
9. Location: As indicated on drawings. Verify with equipment installer at jobsite.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### 3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION 26 05 83

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 08 00  
ELECTRICAL COMMISSIONING REQUIREMENTS

**PART 1 - GENERAL**

1.01 DESCRIPTION

- A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to division 26.
- B. The commissioning process is primarily the responsibility of the Commissioning Authority, with support for start-up, testing, and commissioning the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process, or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
- C. Work of Division 26 includes:
  - 1. Testing and start-up of the electrical equipment.
  - 2. Providing qualified personnel to assist in commissioning tests to verify equipment/ system performance.
  - 3. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operational and ready for functional testing.
  - 4. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
  - 5. Providing training for the systems specified in Division 26 with coordination of owner by the Commissioning Authority.

1.02 RELATED WORK

- A. All testing and start-up procedures and documentation requirements specified within Division 26.
- B. Section 01 9100 - General Commissioning Requirements
- C. Commissioning functional test procedures that require participation of the Contractors.
- D. Cooperate with the Commissioning Authority in the following manner:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Allow sufficient time before final completion dates so that testing can be accomplished.
2. Provide labor and material to make corrections when required without undue delay.
3. Coordinate all required support of that equipment which is provided to or installed with involvement of Division 23 contractors.

**PART 2 - PRODUCTS**

2.01 TEST EQUIPMENT

- A. Standard certified test equipment for commissioning shall be provided by the Division 26 Contractor.
- B. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

**PART 3 - EXECUTION**

3.01 WORK PRIOR TO COMMISSIONING

- A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 26 has temporary power and start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment and materials per the contract documents and related directives, clarifications, change orders, etc.
- B. The Commissioning Authority will develop a Commissioning Plan. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation.
- C. Specific pre-commissioning responsibilities of Division 26 are as follows:
  1. Normal start-up services required to bring each system into a fully operational state. The Commissioning Authority will not begin the commissioning process until each system is complete and documented, including normal contractor start-up.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. The Contractor shall perform pre-functional tests on the equipment and systems as noted in section 01 9100 General Commissioning Requirements.
  3. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
  4. Pre-functional test forms will be kept in the Contractors job trailer in a Commissioning Field Notebook provided by the Commissioning Authority.
  5. Factory start-up services will be provided for key equipment and systems specified in Division 26. The Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.
- D. Commissioning is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.
- E. The Field Commissioning Notebook will be used to identify and track all pertinent commissioning documentation required during the Installation phase. This Notebook will be assembled by the Commissioning Authority and maintained by the Contractor. The Notebook provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:
1. Summary describing Notebook contents and use.
  2. Copy of Commissioning Plan for contractor field reference.
  3. Listing of all specification documentation requirements listed by specification section, with sign off spots for appropriate contractors.
  4. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.
  5. Prior to functional testing the Commissioning Authority will use this book to verify that all appropriate contractors have completed their work and signed off that they have done so. Once the Commissioning Authority is satisfied that all components of a system are complete functional testing will begin.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.02 PARTICIPATION IN COMMISSIONING

- A. Provide skilled technicians to start up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

### 3.03 WORK TO RESOLVE DEFICIENCIES

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance and or design intent.

### 3.04 ADDITIONAL COMMISSIONING

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.05 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

### 3.06 TRAINING

- A. The Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.
- B. Training will be conducted jointly with the Commissioning Authority, the design engineers, the equipment vendors, and the Contractor. The Contractor will be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

### 3.07 SYSTEMS DOCUMENTATION

- A. Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations will be addressed as required in Division 1. All drawings should be red-lined on two sets. Division 26 as-built drawings should include updated architectural floor plans, and the individual electrical systems in relation to actual building layout.
- B. Maintain as-built red-lines on the job site as required in Division 1.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Authority as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

END OF SECTION 26 08 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 09 23  
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. In-wall time switches.
- E. In-wall interval timers.
- F. Outdoor photo controls.
- G. Daylighting controls.
- H. Lighting contactors.
- I. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies.
- F. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
  - 1. Includes finish requirements for wall controls specified in this section.
  - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- G. Section 26 28 13 - Fuses.
- H. Section 26 51 00 - Interior Lighting.
- I. Section 26 56 00 - Exterior Lighting.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2023.
- C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols 2020.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
- J. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting Current Edition, Including All Revisions.
- M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
- N. UL 916 - Energy Management Equipment Current Edition, Including All Revisions.
- O. UL 917 - Clock-Operated Switches Current Edition, Including All Revisions.
- P. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.
- Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation.  
Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify the Architect and/or the Electrical Engineer of Record of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Samples:
1. Occupancy Sensors: One for each type and color specified.
  2. In-Wall Time Switches: One for each type and color specified.
  3. In-Wall Interval Timers: One for each type and color specified.
  4. Daylighting Control Photo Sensors: One for each type and color specified.
- E. Field Quality Control Reports.
- F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Include detailed information on device programming and setup.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
  3. Electronic Trip Circuit Breakers: Provide one portable test set.
  4. Indicating Lights: Two of each different type.
- I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

#### 1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all occupancy sensors.
- C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.
- D. Provide two year manufacturer warranty for all daylighting controls.

### PART 2 PRODUCTS

#### 2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. General Requirements
  - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 2. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
  - 3. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

#### 2.02 OCCUPANCY SENSORS

- A. Manufacturers:
  - 1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  - 2. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  4. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  5. Or approved equal..
  6. Substitutions: See Section 01 60 00 - Product Requirements.
  7. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
  2. Sensor Technology:
    - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
    - d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
  3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
  4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
  5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
  7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
  8. Sensitivity: Field adjustable.
  9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
  10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
  11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
  12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
  13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
  14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
  15. Wireless Sensors:
    - a. RF Range: 30 feet through typical construction materials.
    - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    - c. Power: Battery-operated with minimum ten-year battery life.
- C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
  - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
  - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
  - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
  - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
  - f. Provide selectable audible alert to notify occupant of impending load turn-off.
  - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
  - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
  3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.
  4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
  - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
  - e. Provide field adjustable dimming preset for occupied state.
  - f. Provide fade-to-off operation to notify occupant of impending load turn-off.
  - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- E. Ceiling Mounted Occupancy Sensors:
- 1. All Ceiling Mounted Occupancy Sensors:
    - a. Description: Low profile occupancy sensors designed for ceiling installation.
    - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
    - c. Provide field selectable setting for disabling LED motion detector visual indicator.
    - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
    - e. Finish: White unless otherwise indicated.
  - 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
3. Ultrasonic Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
  4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
  5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
    - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.
- F. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
    - a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Provide field selectable setting for disabling LED motion detector visual indicator.
  - c. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
- a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
  - b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.
  - c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.
3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
- G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.
1. Fluorescent High Bay Luminaire Mounted Occupancy Sensors: Passive infrared (PIR) type with a field of view of 360 degrees unless otherwise indicated.
- a. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
  - b. Finish: White unless otherwise indicated.
  - c. Circular Coverage Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 20 feet.
  - d. Linear Aisle Coverage Sensors: Capable of detecting motion within an area of 20 feet wide by 60 feet long at a mounting height of 40 feet.
  - e. Accessories:
    - 1) Provide mounting bracket for lowering occupancy sensor such that luminaire does not block sensor field of view where required.
- H. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
  3. Input Supply Voltage: Dual rated for 120/277 V ac.
  4. Load Rating: As required to control the load indicated on drawings.
- I. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
  2. Input Supply Voltage: Dual rated for 120/277 V ac.
  3. Load Rating: As required to control the load indicated on drawings.
  4. Provide auxiliary contact closure output where indicated.
  5. Rated Life of Relay: One million cycles.
- J. Accessories:
1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated on plans.
- K. OUTDOOR MOTION SENSORS
1. Manufacturers:
    - a. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
    - b. Hubbell Lighting, Inc: [www.hubbellighting.com/#sle](http://www.hubbellighting.com/#sle).
    - c. Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
    - d. RAB Lighting, Inc: [www.rablighting.com/#sle](http://www.rablighting.com/#sle).
    - e. Or approved equal.
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
    - g. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
  2. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
4. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.
5. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
6. Integral Photocell: For dusk to dawn operation.
7. Manual Override: Activated by switching power off to unit and then back on.
8. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
9. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.
10. Finish: Color to be selected by architect.
11. Provide integral lamp holders suitable for two 150 watt PAR 38 lamps.

L. TIME SWITCHES

1. Manufacturers:
  - a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
  - c. Or approved equal.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - e. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
2. Digital Electronic Time Switches:
  - a. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
  - b. Program Capability:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 1) 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
  - 2) 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
  - 3) Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
- c. Schedule Capacity: Not less than 16 programmable on/off operations.
  - d. Provide automatic daylight savings time and leap year compensation.
  - e. Provide power outage backup to retain programming and maintain clock.
  - f. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
  - g. Provide remote photocell input with light level adjustment.
  - h. Input Supply Voltage: As indicated on the drawings.
  - i. Output Switch Configuration: As required to control the load indicated on drawings.
  - j. Output Switch Contact Ratings: As required to control the load indicated on drawings.
  - k. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
    - 1) Indoor clean, dry locations: Type 1.
    - 2) Outdoor locations: Type 3R.
  - l. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.
3. Electromechanical Time Switches:
    - a. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Program Capability:
  - 1) 24-Hour Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days.
  - 2) 7-Day Time Switches: Capable of different schedule for each day of the week.
  - 3) Astronomic Time Switches: With same schedule for each day of the week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
- c. Schedule Capacity:
  - 1) 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.
  - 2) 7-Day Time Switches: Accommodating not less than two pairs of selected on/off operations per day.
  - 3) Astronomic Time Switches: Capable of turning load on at sunset and off at either sunrise or selected fixed time.
- d. Provide spring reserve backup to maintain clock during power outage.
- e. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
- f. Input Supply Voltage: As indicated on the drawings.
- g. Output Switch Configuration: As required to control the load indicated on drawings.
- h. Output Switch Contact Ratings: As required to control the load indicated on drawings.
- i. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
  - 1) Indoor clean, dry locations: Type 1.
  - 2) Outdoor locations: Type 3R.
- j. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.

M. IN-WALL TIME SWITCHES



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Manufacturers:
  - a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
  - c. Or approved equal.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - e. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
  
2. Digital Electronic In-Wall Time Switches:
  - a. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
  - b. Program Capability:
    - 1) 7-Day Time Switches: Capable of different schedule for each day of the week.
    - 2) Astronomic Time Switches: Capable of different schedule for each day of the week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
  - c. Schedule Capacity: Not less than 40 programmable on/off operations.
  - d. Provide automatic daylight savings time compensation.
  - e. Provide power outage backup to retain programming and maintain clock.
  - f. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
  - g. Switch Configuration: Suitable for use in either SPST or 3-way application.
  - h. Contact Ratings: As required to control the load indicated on drawings.

N. OUTDOOR PHOTO CONTROLS

1. Manufacturers:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - b. Tork, a division of NSI Industries LLC: [www.tork.com/#sle](http://www.tork.com/#sle).
  - c. Substitutions: See Section 01 60 00 - Product Requirements.
  - d. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
2. Stem-Mounted Outdoor Photo Controls:
- a. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
  - b. Housing: Weatherproof, impact resistant polycarbonate.
  - c. Photo Sensor: Cadmium sulfide.
  - d. Provide external sliding shield for field adjustment of light level activation.
  - e. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
  - f. Voltage: As required to control the load indicated on the drawings.
  - g. Failure Mode: Fails to the on position.
  - h. Load Rating: As required to control the load indicated on the drawings.
  - i. Provide accessory wall-mounting bracket where indicated or as required to complete installation.
3. Locking Receptacle-Mounted Outdoor Photo Controls
- a. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
  - b. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
  - c. Photo Sensor: Cadmium sulfide.
  - d. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- e. Voltage: As required to control the load indicated on the drawings.
- f. Failure Mode: Fails to the on position.
- g. Load Rating: As required to control the load indicated on the drawings.
- h. Surge Protection: 160 joule metal oxide varistor.
- i. Provide the following accessories where indicated or as required to complete installation:
  - 1) Receptacle: Complying with ANSI C136.10.
  - 2) Mounting Bracket.
  - 3) Shorting Cap: Suitable for replacing locking photo control to complete circuit.

4. Button Type Outdoor Photo Controls

- a. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
- b. Housing: Weather resistant polycarbonate.
- c. Photo Sensor: Cadmium sulfide.
- d. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
- e. Voltage: As required to control the load indicated on the drawings.
- f. Failure Mode: Fails to the on position.
- g. Load Rating: As required to control the load indicated on the drawings.

O. DAYLIGHTING CONTROLS

1. Manufacturers:

- a. Hubbell Control Solutions:  
[www.hubbell.com/hubbellcontrolsolutions/en/#sle](http://www.hubbell.com/hubbellcontrolsolutions/en/#sle).
- b. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
- c. Sensor Switch Inc: [www.sensorswitch.com/#sle](http://www.sensorswitch.com/#sle).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. WattStopper: [www.wattstopper.com/#sle](http://www.wattstopper.com/#sle).
  - e. Or approved equal.
  - f. Substitutions: See Section 01 60 00 - Product Requirements.
  - g. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
2. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
3. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
- a. Sensor Type: Filtered silicon photo diode.
  - b. Sensor Range:
    - 1) Indoor Photo Sensors: 5 to 100 footcandles.
    - 2) Outdoor Photo Sensors: 5 to 250 footcandles.
    - 3) Atrium Photo Sensors: 200 to 2,500 footcandles.
    - 4) Skylight Photo Sensors: 1,000 to 6,000 footcandles.
    - 5) Open Loop Photo Sensors: 3 to 6,000 footcandles.
  - c. Finish: White unless otherwise indicated.
4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
5. Wireless Daylighting Control Photo Sensors:
- a. RF Range: 30 feet through typical construction materials.
  - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
  - c. Power: Battery-operated with minimum ten-year battery life.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

6. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
  7. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
    - a. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
    - b. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
    - c. Control Capability:
      - 1) Single Zone Switching Modules: Capable of controlling one programmable channel.
      - 2) Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.
- P. Daylighting Control Switching Modules for Wireless Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
  2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
  3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
  4. Control Capability: Capable of controlling one programmable channel.
  5. Input Supply Voltage: Dual rated for 120/277 V ac.
  6. Load Rating: As required to control the load indicated on drawings.
  7. Provide auxiliary contact closure output where indicated.
  8. Rated Life of Relay: One million cycles.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

9. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
  - a. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
  - b. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
  - c. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
  - d. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
  - e. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
  - f. Output Voltage: Compatible with specified dimming ballasts.
  
- Q. Daylighting Control Dimming Modules for Wireless Sensors:
  1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
  2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
  3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
  4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.
  5. Power Packs for Low Voltage Daylighting Control Modules:
    - a. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Input Supply Voltage: Dual rated for 120/277 V ac.
- 6. Load Ratings: As required to control the load indicated on drawings.
- 7. Accessories:
  - a. Where indicated, provide compatible accessory wall switches for manual override control.
- 8. Where indicated, provide compatible accessory wireless controls for manual override control.

R. LIGHTING CONTACTORS

- 1. Manufacturers:
  - a. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
  - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - c. Rockwell Automation Inc; Allen-Bradley Products:  
[ab.rockwellautomation.com/#sle](http://ab.rockwellautomation.com/#sle).
  - d. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
  - e. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
  - f. Or approved equal.
  - g. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- 3. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect.
  - a. Disconnects: Circuit breaker type.
    - 1) Disconnect Switches: Fusible type unless otherwise indicated.
    - 2) Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 3) Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Short Circuit Current Rating:
  - a. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
5. Enclosures:
  - a. Comply with NEMA ICS 6.
  - b. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - 1) Indoor Clean, Dry Locations: Type 1 or Type 12.
    - 2) Outdoor Locations: Type 3R or Type 4.
  - c. Finish: Manufacturer's standard unless otherwise indicated.

S. ACCESSORIES

1. Auxiliary Contacts:
  - a. Comply with NEMA ICS 5.
  - b. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
2. Pilot Devices:
  - a. Comply with NEMA ICS 5; heavy-duty type.
  - b. Nominal Size: 30 mm.
  - c. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
  - d. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
  - e. Indicating Lights: Push-to-test type unless otherwise indicated.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- f. Provide LED lamp source for indicating lights and illuminated devices.
3. Control and Timing Relays:
- a. Comply with NEMA ICS 5.
  - b. Provide number and type of relays indicated or required to perform necessary functions.
  - c. Timing Relays: Electronic or pneumatic as indicated.
    - 1) Adjustable Timing Range: As indicated on drawings.
4. Fire-Rated Device Enclosures:
- a. Manufacturers:
    - 1) Fire Rated Product Specialties Corp: [www.frpsonline.com/#sle](http://www.frpsonline.com/#sle).
    - 2) Or approved equal.
    - 3) Substitutions: See Section 01 60 00 - Product Requirements.
  - b. Provide as required to preserve fire resistance rating of building elements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with CEC 2007.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1, including mounting heights specified in that standard unless otherwise indicated
- C. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.
  - 1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  - 2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect and/or Owner's Representative to obtain direction prior to proceeding with work.
- D. Install lighting control devices in accordance with manufacturer's instructions.
- E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- F. Install lighting control devices plumb and level, and held securely in place.
- G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.
- H. Provide required supports in accordance with Section 26 05 29.
- I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- J. Identify lighting control devices in accordance with Section 26 05 53.
- K. Occupancy Sensor Locations:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
  2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- L. Outdoor Photo Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
  2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- N. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
  2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
  3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- O. Combination Enclosed Lighting Contactors:
1. Except where indicated to be mounted adjacent to the equipment they supply, mount lighting contactors such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- P. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- Q. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- R. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- S. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
- T. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 05 33.16 for mounting of lighting control device system components.
- U. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 2716 for mounting of lighting control device system components.

### 3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.
- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by manufacturer.
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Owner's Representative.. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by LP Consulting Engineers, Inc..
- G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Ownere's Representative.

### 3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### 3.07 COMMISSIONING

- A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

### 3.08 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Demonstration: Demonstrate proper operation of lighting control devices to District Representative, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's (Owner's) personnel on operation, adjustment, programming, and maintenance of lighting control devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
  - 4. Location: At project site.

END OF SECTION 26 09 23

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 22 00  
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose dry type, two winding transformers.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 53 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 00 – Common Work Results for Electrical
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 33.13 - Conduit for Electrical Systems: Flexible conduit connections.
- F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- G. Section 26 05 53 - Identification for Electrical Systems: Identification of products and requirements.
- H. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. NEMA ST 20 - Dry Type Transformers for General Applications 2021.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NETA ATS - Standard for Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.
- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
  1. Vibration Isolators: Include attachment method and rated load and deflection.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
  - 1. Include outline and support point dimensions of enclosure and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.
  - 2. Small Power Centers: Include panel arrangements.
  - 3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Maintenance Data: Include recommended maintenance procedures and intervals.
- I. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
  - 1. Greater than 10 kVA: 104 degrees F maximum.
  - 2. Less than 10 kVA: 77 degrees F maximum.

1.09 WARRANTY

- A. All transformers and components shall have a minimum 2 year warranty.
- B. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Cutler-Hammer.
- F. Or approved equal.
- G. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide transformers suitable for application under seismic design criteria in accordance with Section 26 05 48 where required. Include certification of compliance with submittals.
- C. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
  - 1. Altitude: Less than 3,300 feet.
  - 2. Ambient Temperature:
    - a. Greater than 10 kVA: Not exceeding 104 degrees F.
    - b. Less than 10 kVA: Not exceeding 77 degrees F.
- D. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- E. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- F. Basic Impulse Level: 10 kV for transformers less than 300 KVA, 30 KV for transformers 300 KVA and larger..
- G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- H. Isolate core and coil from enclosure using vibration-absorbing mounts.
- I. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Insulation System and Allowable Average Winding Temperature Rise:
  - 1. Less than 15 kVA: Class 180 degrees C insulation system with 80 degrees C average winding temperature rise.
  - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- F. Winding Taps:
  - 1. Less than 3 kVA: None.
  - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
  - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
  - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: NEMA ST 20: 2016 DOE energy efficiency standards, factory assembled, air cooled, dry type transformers; ratings as shown on drawings. Comply with 10 CFR 431, Subpart K.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20
  - 1. 0-9 kVA: 40 dB.
  - 2. 10-50 kVA: 45 dB.
  - 3. 51-150 kVA: 50 dB.
  - 4. 151-300 kVA: 55 dB.
  - 5. 301-500 kVA: 60 dB.
  - 6. 501-700 kVA: 62 dB.
  - 7. 701-1000 kVA: 64 dB.
- I. Mounting Provisions:
  - 1. Less than 15 kVA: Suitable for wall or floor mounting.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
  3. Larger than 75 kVA: Suitable for floor mounting.
  4. Transformers mounted on walls, columns, or structures shall be located in the open free of obstructions that block openings for ventilation.
- J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor clean, dry locations: Type 1.
    - b. Outdoor locations: Type 3R.
  2. Construction: Steel.
    - a. Less than 15 kVA: Totally enclosed, non-ventilated.
    - b. 15 kVA and Larger: Ventilated.
    - c. Enclosure cover plates shall be code gauge sheet steel, captive bolted to the enclosure framework.
    - d. Enclosure shall have suitable ventilating openings and rodent proof screens.
  3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
    - a. Metal parts excepting cores and core mounting frames shall be cleaned, rust-proofed, and given a heavy coat of an inert primer. Cover plates and external metal parts shall be furnished with two full-bodies coatings of oil-resistant industrial gray enamel.
  4. Enclosures shall be provided with lifting eyes or brackets as required..
- K. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
  2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
  3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.04 SOURCE QUALITY CONTROL

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure. Flexible jumpers shall be installed for grounding continuity from enclosure to conduits or bus ducts.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level. Installation shall be in accordance with manufacturer's instructions.
- G. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure. Mounting bolts on floor mounted transformers shall extend into pads only and shall not be in direct contact with building structural members.
- H. Transformer conduit windows shall be filled with crushed rock and sealed with one inch of lightweight grout after conduits are installed.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. When installed outdoors, pad mounted transformers shall be installed to maintain sixteen-foot clearance from the lowest point of building roofs to the top of the transformer enclosure, and other obstructions to avoid use as a step to building roofs. Maintain minimum of eight-foot clearance in front of transformer.
- J. Primary electrical equipment shall be anchored to concrete base in accordance with seismic zone 4 design requirements.
- K. Where indicated on drawings, install transformer on housekeeping pad. Install pad in accordance with Section 03 30 00.
- L. Transformer Support:
  - 1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
  - 2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 05 48.
  - 3. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
  - 4. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
  - 5. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- M. Provide grounding and bonding in accordance with Section 26 05 26.
- N. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- O. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- P. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.
- Q. Identify transformers in accordance with Section 26 05 53.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
  - 1. 167 kVA single phase, 500 kVA three phase and smaller:
    - a. Perform turns ratio tests at all tap positions.
  - 2. Larger than 167 kVA single phase and 500 kVA three phase:
    - a. Verify that control and alarm settings on temperature indicators are as specified.
    - b. Perform excitation-current tests on each phase.
    - c. Measure the resistance of each winding at each tap connection.
    - d. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

3.04 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 22 00



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 24 16  
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.
- D. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- G. Section 26 27 13 - Electricity Metering: For interface with equipment specified in this section.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 1 - Panelboards 2011.
- H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less 2023.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- M. UL 67 - Panelboards Current Edition, Including All Revisions.
- N. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- P. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- Q. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- R. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.
- S. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  4. Include documentation of listed series ratings upon request.
  5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- F. Field Quality Control Test Reports.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Panelboard Keys: Two of each different key.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Conform to requirements of NFPA 70.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Or approved equivalent subject to substitution process
- F. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
  2. Listed series ratings are not acceptable, except where pre-approved by the Owner and LP Consulting Engineers, Inc.
  3. Label equipment utilizing series ratings as required by NFPA 70 where permitted.
- E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
  3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Boxes: Galvanized steel unless otherwise indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
  - c. Provide removable end walls for NEMA Type 1 enclosures.
  - d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
- a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
  - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated. Provide door-in-door construction.
- K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- M. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
1. Ampere Rating: Not less than ampere rating of panelboard bus.
  2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  3. Coil Voltage: As required for connection to control system indicated.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
  - a. Use zero sequence ground fault detection method unless otherwise indicated.
  - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
  - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- P. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
  1. Feed-through lugs.
  2. Sub-feed lugs.

### 2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  1. Main and Neutral Lug Material: Suitable for terminating aluminum or copper conductors.
  2. Main and Neutral Lug Type: Mechanical.
    - a. Provide an individual terminal or lug for each neutral wire.
- C. Bussing:
  1. Phase and Neutral Bus Material: Copper.
  2. Ground Bus Material: Copper.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

D. Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
3. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
4. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
5. Provide clear plastic circuit directory holder mounted on inside of door.
6. Painted gray over rust inhibiting primer.

F. Description: NEMA PB 1, circuit breaker type.

G. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

H. Minimum integrated short circuit rating: As indicated or as required by the short circuit study.

1. 240 Volt Panelboards: amperes rms symmetrical per plan.
2. 480 Volt Panelboards: amperes rms symmetrical per plan.

I. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

J. Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower, with bimetal overload relay.

1. Coil operating voltage: 120 volts, 60 Hz.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Size as shown on Drawings.
- K. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- L. Enclosure: NEMA PB 1, Type 1, 6 inches deep, 20 inches wide, cabinet box.
- M. Cabinet Front: Surface type, fastened with screws, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.
- N. Nameplate: Provide factory nameplate to include the following:
  1. Manufacturer.
  2. Order number.
  3. Panelboard Type.
  4. System Voltage.
  5. Bus ampacity.
  6. Short circuit bracing rating.
  7. UL label.
  8. Service entrance label. (if applicable)

#### 2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  1. Main and Neutral Lug Material: Suitable for terminating aluminum or copper conductors. .
  2. Main and Neutral Lug Type: Mechanical.
    - a. Provide an individual terminal or lug for each neutral wire.
- C. Bussing:
  1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
  - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 4. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.
- G. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- H. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard ; provide insulated ground bus where scheduled.
- I. Minimum Integrated Short Circuit Rating: As indicated or as required by the short circuit study.
  - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
  - 2. 480 Volt Panelboards: 14,000 amperes rms symmetrical.
- J. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
  - 1. Type SWD for lighting circuits.
  - 2. Type HACR for air conditioning equipment circuits.
  - 3. Class A ground fault interrupter circuit breakers where scheduled.
  - 4. Do not use tandem circuit breakers.
- K. Enclosure: NEMA PB 1, Type 1.
- L. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

M. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

N. Special Features:

1. Provide blocking clips or lock-off devices on circuit breakers as indicated on the drawings.
2. Provide barriered space for mounting contactors and control devices with a hinged door and lock, where shown or required.
3. Provide neutral bars with terminal for all active, spare, and inactive circuits.
4. Provide feed-thru lugs or sub-feed lugs for 2 and 3 section panels.
5. Equip bus bars for panelboard with main lugs, main fused switch, or main circuit breaker, capacity as required or as indicated.
6. Provide special features such as split bus, lighting contactors, extra-wide gutters as required or as indicated.
7. Provide panels with individual branch circuit power metering where noted on plans for connections to Facility Energy Management System. Provide Square D type NFMVP, NQMVP or approved equal.

## 2.05 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install panelboards plumb and when recessed, flush with wall finishes. Provide all backing for equipment support. Fasten all free-standing equipment to concrete slab. Mounting bolts on floor mounted panels shall extend into pads only and shall not be in direct contact with building structural members.
- H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- I. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- J. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- K. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- L. Provide grounding and bonding in accordance with Section 26 05 26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- M. Install all field-installed branch devices, components, and accessories.
- N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- P. Set field-adjustable circuit breaker tripping function settings as indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- Q. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- R. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- S. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- T. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- U. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- V. Provide filler plates to cover unused spaces in panelboards.
- W. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- X. Identify panelboards in accordance with Section 26 05 53.
- Y. Provide computer-generated circuit directory card for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
- Z. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- AA. Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- BB. Provide arc flash warning labels in accordance with NFPA 70.
- CC. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
  - 1. Minimum spare conduits: 6 empty 1 inch.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

DD. Ground and bond panelboard enclosure according to Section 26 05 26.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform field inspection and testing in accordance with Section 01 40 00.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes.. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Test shunt trips to verify proper operation.
- I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- J. Correct deficiencies and replace damaged or defective panelboards or associated components.
- K. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

### 3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 24 16



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 27 26  
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates and covers.
- E. Access floor boxes.
- F. Occupancy sensors

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.
- G. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interruptioners Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- M. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.
- O. UL 1917 - Solid-State Fan Speed Controls Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify the Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
  1. Wall Dimmers: Include derating information for ganged multiple devices.
  2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.
- C. Samples: One for each type and color of device and wall plate specified.
- D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data:
  1. Wall Dimmers: Include information on operation and setting of presets.
  2. GFCI Receptacles: Include information on status indicators.
  3. Surge Protection Receptacles: Include information on status indicators.
- H. Project Record Documents: Record actual installed locations of wiring devices.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
3. Extra Keys for Locking Switches: Two of each type.
4. Extra Surge Protection Receptacles: Two of each type.
5. Extra Wall Plates: One of each style, size, and finish.
6. Extra Flush Floor Service Fittings: Two of each type.
7. Extra Poke-Through Core Hole Closure Plugs: Two for each core size.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Leviton Manufacturing, Inc: [www.leviton.com](http://www.leviton.com).
- D. Pass & Seymore.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Hubbell.
- F. Bryant.
- G. Arrow-Hart.
- H. Or approved equal.

## 2.02 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather-resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations. Receptacles to be clearly identified as weather resistant as required by CEC.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.
- I. Unless noted otherwise, do not use combination switch/receptacle devices.
- J. For flush floor service fittings, use tile rings for installations in tile floors.
- K. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

## 2.03 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- F. Isolated Ground Convenience Receptacles: Orange.
- G. Surge Protection Receptacles: Blue.
- H. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.
- I. Clock Hanger Receptacles: Brown with stainless steel wall plate.
- J. Above-Floor Service Fittings: Gray wiring devices with satin aluminum housing.
- K. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.
- L. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.
- M. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

#### 2.04 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 2.05 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
  - 1. Products:
    - a. Single-pole: Hubbell #1221-I, Bryant #4901-GI, Pass & Seymour #20AC1-I.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Double-pole: Hubbell #1222-I, Brant #4902-GI, Pass & Seymour #20AC2-I.
  - c. Three-way: Hubbell #1223-I, Bryant #4903-GI, Pass & Seymour #20AC3-I.
  - d. Four-way: Hubbell #1224-I, Bryant #4904-GI, Pass & Seymour #20AC4-I.
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- 1. Products:
    - a. Hubbell #1221-PLR, Bryant #4901-PLR, Pass & Seymour #20AC1-PLR.
    - b. Or approved equal.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with barrel type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- F. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.
- G. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.
- H. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
- 1. Body and Handle: white plastic with toggle handle.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Indicator Light: Lighted handle type switch; red handle.
  3. Locator Light: Lighted handle type switch; red color handle.
  4. Ratings:
    - a. Voltage: 120 and 277 volts, AC.
    - b. Current: 20 amperes.
- I. Switch Types: Single pole, double pole, and 3-way.

## 2.06 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- B. Control: Slide control type with separate on/off switch.
- C. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
  1. Incandescent: 600 W.
  2. Magnetic Low-Voltage: 600 VA.
  3. Electronic Low-Voltage: 400 VA.
  4. Fluorescent: 600 VA.
  5. LED: 600 VA
- D. Provide locator light, illuminated with load off.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.
- F. Incandescent Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
  1. Body and Handle: white plastic with linear slide control.
  2. Voltage: 120 and 277 volts.
  3. Power Rating: 600 watts.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. LED Wall Dimmers: NEMA WD 1, Type II semiconductor dimmer for LED lamps.
  - 1. Power rating to match load shown on the drawings.
  - 2. Voltage as required for controlled LED fixtures.
- H. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## 2.07 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498 and where applicable FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
  - 3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- B. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  - 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  - 3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
  - 4. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  - 5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  7. Illuminated Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; illuminated face or indicator light to indicate power is being supplied to receptacle; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
    - a. Provide test and reset buttons of same color as device.
  2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
  4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
  5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
- D. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
- E. Special Purpose Receptacle Outlet: .20A, 250V, 3 pole, 4 wire, 3 phase grounding, single: NEMA 15-20R; black (Hubbell 8420).
- F. Special Purpose Receptacle Outlet: 20A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single: NEMA 14-20R; black (Hubbell 8410).

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Special Purpose Receptacle Outlet: 30A, 125V, 2 pole, 3 wire grounding, single; NEMA 5-30R; black (Hubbell 9308).
- H. Special Purpose Receptacle Outlet: 30A, 250V, 2 pole, 3 wire grounding, single; NEMA 6-30R; black (Hubbell 9330).
- I. Special Purpose Receptacle Outlet: 30A, 250V, 3 pole, 4 wire, 3 hose, grounding, single; NEMA 15-30R; black (Hubbell 8430A).
- J. Special Purpose Receptacle Outlet: 30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single; NEMA 14-30 R; black (Hubbell 9430A).
- K. Special Purpose Receptacle Outlet: 30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, twist-lock; NEMA L6-30R; black (Hubbell 2620).
- L. Special Purpose Receptacle Outlet: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, twist-lock; NEMA L15-30R; black (Hubbell 2720).
- M. Special Purpose Receptacle Outlet: 50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single; NEMA 6-50R; black (Hubbell 9367).
- N. Special Purpose Receptacle Outlet: 50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; black (Hubbell 25505), with wall plate per NFPA 56A. Portable x-ray receptacle.
- O. Special Purpose Receptacle Outlet: 20A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; NEMA L6-20R; black (Hubbell 2320).
- P. Special Purpose Receptacle Outlet: 50A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single; NEMA 14-50R; black (Hubbell 9450A).
- Q. Special Receptacle: 20A, 4 pole, 5 wire, 3 phase Y, 120/208V; NEMA L21-20; black (Hubbell 2510).
- R. Special Receptacle: 30A, 4 pole, 5 wire, 3 phase Y, 120/208V; NEMA L21-30; black (Hubbell 2810).
- S. Special Purpose Receptacle Outlet: 15A, 125V, 2 pole, 3 wire, isolated ground, duplex; NEMA 5-15R; orange (Hubbell IG-5262).
- T. Special Purpose Receptacle Outlet: 20A, 125V, 2 pole, 3 wire, isolated ground, duplex; NEMA 5029R; orange (Hubbell IG-5362).
- U. Special Purpose Receptacle Outlet: 30A, 125V, 2 pole, 3 wire, 1 phase, grounding, single, twist-lock; NEMA L5-30R; black (Hubbell 2610).
- V. Special Purpose Receptacle Outlet: 20A, 125V, 2 pole, 3 wire, single, twist-lick; NEMA L5-20R; black.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- W. Special Receptacle Outlet: 30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, twist lock, isolated ground; NEMA L6-30R; orange (Hubbell IG-2620).
- X. Special Receptacle Outlet: 30A, 4 pole, 5 wire, 3 phase Y, 277/408V; NEMA L22-30, black.
- Y. Special Receptacle Outlet: 60A, 3 pole, 4 wire, 3 phase, 480V; watertight pin and sleeve type; red, Hubbell 460R7W with BB601W 15 degree angle back box.
- Z. Special Receptacle Outlet: 60A, 277/480V, 4 pole, 5 wire, single pin and sleeve.
  - 1. Manufacturers
    - a. Appleton.
    - b. Hubbell; Model 560R7W.
    - c. Or approved equal.
- AA. Special Receptacle Outlet: 60A, 250V, 3 pole, 4 wire, 3 phase, grounding, single; NEMA 15-60R; black.
  - 1. Manufacturers
    - a. Bryant; Model 8460.
    - b. Hubbell; Model 8460A.
    - c. Pass & Seymour; Model 5760-BL.
    - d. Or approved equal.
- BB. Other receptacle types as indicated on the drawings and/or as required for connection of designated equipment.

## 2.08 WALL PLATES AND COVERS

- A. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
  - 4. Provide screwless wallplates with concealed mounting hardware where indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.
- E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.
- F. Chrome Wall Plates: Smooth finish, chrome plated steel.
- G. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- H. Pre-marked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.
- I. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- J. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
- K. Decorative Cover Plates: white, nylon, verify color with architect .
- L. Jumbo Cover Plates: white, nylon, verify color with architect.
- M. Weatherproof Cover Plates: Gasketed cast metal with hinged.
- N. Inmate Areas: In Correctional Facilities
  - 1. Minimum Level Device Plate: Type 430 stainless steel, flush, satin finish, approximately 20 gauge.
    - a. Hollow Metal Jamb Posts: Arrow-Hart #T-1650; Bryant, Stainless Steel.
  - 2. Medium Level Device Plate: Stainless steel; Type 430.
  - 3. Maximum Level Device Plate:
    - a. Back Plate: Cold rolled steel; 10 gauge, prime painted.
    - b. Cover Plate: Steel; 10 gauge, prime painted.
    - c. Fasteners: Minimum for security fasteners.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Manufacturers: Hubbell, Fail-Safe, Mark.
- e. Cast Metal Plate for Surface Type Boxes: Corrosive resistant, cast ferrous metal, designed for the application.
- f. Plastic Device Plates: Not permitted.
- g. Fasteners: Tamper proof metal fasteners under provisions of Section 05 05 23.
- h. Device Plates Installed in Housing Units: Patient Cells, Holding Cells, and Receiving Tanks shall be maximum level device plates.
- i. Device Plates Installed In Mechanical Rooms, Electrical Rooms, Control Rooms and areas 12 feet or more above finished floor shall be minimum level device plates.
- j. Device plates installed in other areas shall be Medium level device plates.

## 2.09 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.
- B. Above-Floor Service Fittings:
  - 1. Single Service Pedestal Convenience Receptacles:
    - a. Configuration: One standard convenience duplex receptacle.
  - 2. Single Service Pedestal Communications Outlets:
    - a. Configuration: One 1 inch bushed opening.
    - b. Voice and Data Jacks: As specified in Section 27 30 00.
  - 3. Single Service Pedestal Furniture Feed:
    - a. Configuration: One 3/4 inch knockout.
  - 4. Dual Service Pedestal Combination Outlets:
    - a. Configuration:
      - 1) Power: One standard convenience duplex receptacle.
      - 2) Communications: One 1 inch bushed opening.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3) Voice and Data Jacks: As specified in Section 27 30 00.

b. Provide barrier to separate line and low voltage compartments.

C. Flush Floor Service Fittings:

1. Single Service Flush Convenience Receptacles:

a. Cover: Rectangular.

b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).

2. Single Service Flush Communications Outlets:

a. Cover: Rectangular.

b. Voice and Data Jacks: As specified in Section 27 30 00.

3. Single Service Flush Furniture Feed:

a. Cover: Rectangular.

b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).

4. Dual Service Flush Combination Outlets:

a. Cover: Rectangular.

b. Configuration:

1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).

2) Voice and Data Jacks: As specified in Section 27 30 00.

5. Dual Service Flush Furniture Feed:

a. Cover: Rectangular.

b. Configuration:

1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).

2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).

6. Accessories:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
- b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## 2.10 ACCESS FLOOR BOXES

- A. Manufacturers - Access Floor Boxes with Pre-wired Connectors for Manufactured Wiring Systems:
  1. AFC Cable Systems Inc: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  2. RELOC Wiring Solutions, a brand of Acuity Brands, Inc: [www.relocwiring.com/#sle](http://www.relocwiring.com/#sle).
  3. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  4. Or approved equal.
  5. Substitutions: See Section 01 60 00 - Product Requirements.
  6. Source Limitations: Provide access floor boxes with pre-wired connectors produced by the same manufacturer as the manufactured wiring system used for this project.
- B. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 09 69 00.
- C. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 26 05 19.
- D. Configuration:
  1. Power: Two standard convenience duplex receptacle(s) unless noted otherwise on drawings.
  2. Voice and Data Jacks: As specified in Section 27 30 00.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that openings in access floor are in proper locations.
- I. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, except for mounting heights specified in those standards.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1, except for mounting heights specified in that standard.
- C. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
  - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Owner to obtain direction prior to proceeding with work.
  - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Install wiring devices in accordance with manufacturer's instructions.
- E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
- J. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- K. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.
- L. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- M. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- N. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- O. Install wall switches with OFF position down.
- P. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- Q. Do not share neutral conductor on branch circuits.
- R. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- S. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- T. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- U. Identify wiring devices in accordance with Section 26 05 53.
- V. Install identification label for wall switches and wall dimmers in accordance with Section 26 0526 indicating load served when controlling loads that are not visible from the control location or multiple wall switches or wall dimmers are installed at one location.
- W. Install identification label for all receptacles in accordance with Section 26 0526 indicating serving branch circuit.
- X. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.
- Y. Install receptacles with grounding pole on bottom.
- Z. Connect wiring device grounding terminal to outlet box with bonding jumper.
- AA. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- BB. Connect wiring devices by wrapping conductor around screw terminal.
- CC. Use jumbo size plates for outlets installed in masonry walls.
- DD. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- EE. Install protective rings on active flush cover service fittings.

### 3.04 CONSTRUCTION

- A. Interface with Other Work
  - 1. Coordinate locations of outlet boxes to obtain mounting heights specified unless otherwise indicated on drawings. All dimensions are to the center of the item.
  - 2. Install convenience receptacle four inches above backsplash of counters or four inches above counter if no backsplash. Mount horizontal where indicated

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Install electric water cooler outlet boxes centered behind unit, behind electric water cooler cover. Coordinate with equipment installer.
- B. Locate wall switches on the strike side of door with edge of wall plate three inches from edge of door frame. Where locations are indicated otherwise, notify the Electrical Engineer of Record to obtain direction prior to proceeding with work.

### 3.05 FIELD QUALITY CONTROL

#### A. Site Test

1. Test under provisions of Section 01 45 00.
  2. See Section 01 40 00 - Quality Requirements, for additional requirements.
  3. Operate each wall switch, wall dimmer and fan speed control with circuit energized and verify proper operation.
  4. Test each receptacle to verify operation and proper polarity.
  5. Verify that each receptacle is energized.
  6. Test each GFCI receptacle for proper tripping operation and proper polarity.
  7. Inspect each surge protection receptacle to verify surge protection is active.
- B. Inspect each wiring device for damage and defects.
- C. Correct wiring deficiencies and replace damaged or defective wiring devices.

### 3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Owner's Representative.

### 3.07 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 28 13  
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.
- B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 24 13 - Switchboards: Fusible switches.
- D. Section 26 24 16 - Panelboards: Fusible switches.
- E. Section 26 28 16.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses Current Edition, Including All Revisions.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.
- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
  - a. Fusible Enclosed Switches: See Section 26 28 16.16.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
1. Spare Fuse Cabinet: Include dimensions.
- C. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Fuses: Three set(s) of three for each type and size installed.
  3. Fuse Pullers: One set(s) compatible with each type and size installed.
  4. Spare Fuse Cabinet Keys: Two.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience and with service facilities within 100 miles of Project.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Cooper Bussmann
- B. Ferraz Shawmut, Inc
- C. Littelfuse
- D. Gould
- E. Or approved equal.
- F. Substitutions: See Section 01 60 00 - Product Requirements.

### 2.02 APPLICATIONS

- A. Service Entrance:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.
- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.
- G. HVAC equipment: Provide fuses, size, type, and ratings in accordance with equipment nameplate data to be field verified by contractor.

### 2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
  - 1. Class RK1, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann, "Low-Peak"; 250V KTN-RK and 600V LPS-RK.
      - 2) Littlefuse, "Little-Peak" 250V LLN-RK and 600V LLS-RK.
      - 3) Gould "AMPTRAP II" 250V A2D-R and 600V A6D-R.
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Class RK1, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann "Limitron", 250V KTN-RK and 600V KTS-RK..
      - 2) Littlefuse 250V RLN-R and 600V RLS-R.
      - 3) Gould "AMPTRAP" 250V A2K-R and 600V A6K-R..
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
  - 3. Class RK5, Time-Delay Fuses:
    - a. Products:
      - 1) Bussmann "Fusetron" 250V FRN-RK and 600V FRS-RK.
      - 2) Littlefuse "SLO-BLO" 250V FLN-R and 600V FLS-R.
      - 3) Gould "TRI-ONIC" 250V TR-R and 600V TRS-R.
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
  - 4. Class RK5, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- 1) Bussmann 300V "T-Tron" JJN, 600V "Limitron" JKS.
- 2) Substitutions: See Section 01 60 00 - Product Requirements.

H. Class J Fuses: Comply with UL 248-8.

1. Class J, Time-Delay Fuses:
  - a. Products:
    - 1)
    - 2) Substitutions: See Section 01 60 00 - Product Requirements.
2. Class J, Fast-Acting, Non-Time-Delay Fuses:
  - a. Products:
    - 1) Bussmann 300V JJN, 600V JKS.
    - 2) Substitutions: See Section 01 60 00 - Product Requirements.

I. Class L Fuses: Comply with UL 248-10.

1. Class L, Time-Delay Fuses:
  - a. Products:
    - 1) Bussmann "Hi-Cap" 600V, 601-6000A, Type KRP-C.
    - 2) Littlefuse "HI-INT" 600V, 601-6000A, Type KLP-C.
    - 3) Gould "AMPTRAP" 600V, 200-600A, Type A4BY.
    - 4) Substitutions: See Section 01 60 00 - Product Requirements.
2. Class L, Fast-Acting, Non-Time-Delay Fuses:
  - a. Products:
    - 1) Bussmann 300V KTN-R, 600V KTS-R.
    - 2) Substitutions: See Section 01 60 00 - Product Requirements.

J. Class T Fuses: Comply with UL 248-15.

1. Products:
  - a. Bussmann 300V JJN, 600V JJS.
  - b. Substitutions: See Section 01 60 00 - Product Requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- K. Class CC Fuses: Comply with UL 248-4.
  - 1. Class CC, Time-Delay Fuses:
    - a. Products:
      - 1) Busmann 600V LP-CC.
      - 2) Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Class CC, Fast-Acting, Non-Time-Delay Fuses:
    - a. Products:
      - 1) Busmann 600v, KTK-R.
      - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- M. Provide the following accessories where indicated or where required to complete installation:
  - 1. Fuseholders: Compatible with indicated fuses.
  - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

#### 2.04 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.
- C. Doors: Hinged, with hasp for Owner's (Owner's) padlock.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
- C. Verify that conditions are satisfactory for installation prior to starting work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated on drawings.
- D. Identify spare fuse cabinet in accordance with Section 26 05 53.
- E. Provide identification nameplate for spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION 26 28 13

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 28 16.13  
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical Systems.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- J. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- K. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
  1. Include characteristic trip curves for each type and rating of circuit breaker upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  4. Include documentation of listed series ratings upon request.
  5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual installed locations of enclosed circuit breakers.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Cutler-Hammer.
- F. Or approved equal.
- G. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed circuit breakers and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between 23 degrees F and 104 degrees F.
- E. Short Circuit Current Rating:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.
- F. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Provide thermal magnetic circuit breakers unless otherwise indicated.
- I. Provide electronic trip circuit breakers where indicated.
- J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- K. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
- L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
    - c. Wash down or corrosive locations: NEMA 4X.
  2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
  3. Provide surface-mounted enclosures unless otherwise indicated.
- M. Provide externally operable handle with means for locking in the OFF position.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Use zero sequence ground fault detection method unless otherwise indicated.
  - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
  - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- O. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

### 2.03 MOLDED CASE CIRCUIT BREAKERS

- A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489 and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
- B. Interrupting Capacity:
1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
    - a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
    - b. 14,000 rms symmetrical amperes at 480 VAC.
  2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating determined by the short circuit study provided under Section 26 05 73.
  3. Series Rated Systems: Not permitted unless preapproved by the Owner and Electrical Engineer of Record.
- C. Conductor Terminations:
1. Provide mechanical lugs unless otherwise indicated.
  2. Provide compression lugs where indicated.
  3. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
- D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  2. Provide interchangeable trip units where indicated.
- E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
1. Provide the following field-adjustable trip response settings:
    - a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - b. Long time delay.
    - c. Short time pickup and delay.
    - d. Instantaneous pickup.
    - e. Ground fault pickup and delay where ground fault protection is indicated.
  2. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
  3. Provide communication capability where indicated: Compatible with system indicated.
- F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- G. Provide the following circuit breaker types where indicated:
1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- H. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
- J. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - 2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
  - 3. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
  - 4. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.
- F. Install enclosed circuit breakers plumb.
- G. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- I. Provide grounding and bonding in accordance with Section 26 05 26.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as indicated.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- N. Identify enclosed circuit breakers in accordance with Section 26 05 53.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 100 amperes . Tests listed as optional are not required.
  - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
  - 2. Test functions of the trip unit by means of secondary injection.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.13

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 28 16.16  
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical Systems.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual locations of enclosed switches.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

#### 1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

#### 1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- E. Cutler-Hammer.
- F. Or approved equal.
- G. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

## 2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- E. Horsepower Rating: Suitable for connected load.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Minimum Ratings:
    - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
  - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- I. Provide with switch blade contact position that is visible when the cover is open.
- J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
- 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
- L. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- N. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
- 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
    - c. Wash down and corrosive Locations: Type 4X.
  - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- P. Heavy Duty Switches:
- 1. Comply with NEMA KS 1.
  - 2. Conductor Terminations:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Provide mechanical lugs.
  - b. Provide compression lugs where indicated.
  - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- a. Provide means for locking handle in the ON position where indicated.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
1. Hubs: As required for environment type; sized to accept conduits to be installed.
  2. Integral fuse pullers.
  3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
  4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
  5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept plug as indicated on the drawings.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.
- F. Install enclosed switches plumb.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Identify enclosed switches in accordance with Section 26 05 53.

### 3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

### 3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### 3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16.16

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 51 00  
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Drivers.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 05 00 – Common Work Results for Electrical.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
  - 2. Includes lighting contactors.
- G. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.
- H. Section 26 56 00 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 1989 (Corrigendum 2019).
- D. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- E. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.
- F. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- G. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- I. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
- J. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- K. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- L. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 844 - Luminaires for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- P. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- Q. UL 1598 - Luminaires Current Edition, Including All Revisions.
- R. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect and/or Owner of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  2. Provide photometric calculations where luminaires are proposed for substitution.
  3. Provide shop drawings for continuous row luminaires.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Drivers: Include wiring diagrams and list of compatible lamp configurations.
  4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
  5. Air Handling Luminaires: Include air handling performance data.
- D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- E. Samples:
1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each custom luminaire.
  3. Provide one sample(s) of each luminaire proposed for substitution upon request.
  4. Provide one sample(s) of each product finish illustrating color and texture upon request.
- F. Field quality control reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- I. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
  3. Extra LED Drivers: Two percent of total quantity installed for each type, but not less than one of each type.
- J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC, and ICBO.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Conform to requirements of NFPA 70 and NFPA 101.
- D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.
- C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.
- D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.
- E. Provide 3-year full warranty for fluorescent emergency power supply units.
- F. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

PART 2 PRODUCTS

2.01 MANUFACTURERS - LUMINAIRES

- A. Furnish products as indicated in Lighting Fixture Schedule included on the Drawings
  - 1. General: Lighting fixtures as hereinafter specified are identified by type as noted on drawings. Fixture specifications are based on construction and performance. Manufacturer's catalog numbers are of general nature and indicate the level of quality required, but do not necessarily reflect complete options and accessories required. Approval shall be based on description and specification of fixture as well as catalog number indicated. Verify fixture voltage requirements with circuitry shown on drawings and provide appropriate equipment.

2.02 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
  - a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
  - b. Luminaires for Heat Removal: Provide heat removal dampers where indicated.
- I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- J. LED Luminaires:
  1. Components: UL 8750 recognized or listed as applicable.
  2. Tested in accordance with IES LM-79 and IES LM-80.
  3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.
    - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
  2. White LED Tape:
    - a. Correlated Color Temperature (CCT): 3500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 90.
- L. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

#### 2.04 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
1. Sealed maintenance-free lead calcium unless otherwise indicated.
  2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- G. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- H. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
  2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
  3. Provide compatible accessory wire guards where indicated.
  4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.05 LUMINAIRES

- A. Furnish products as indicated in Lighting Fixture Schedule included on the Drawings.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.06 EXIT SIGNS

- A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
- B. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
  - 2. Directional Arrows: As indicated or as required for installed location.
- C. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
  - 1. Manufacturers:
    - a. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
    - b. Cooper Lighting, a division of Cooper Industries;: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - c. Hubbell Lighting, Inc: [www.hubbellighting.com/#sle](http://www.hubbellighting.com/#sle).
    - d. Philips Lighting North America Corporation; [www.lightingproducts.philips.com/#sle](http://www.lightingproducts.philips.com/#sle).
    - e. Or approved equal.
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Accessories:
  - 1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
  - 2. Provide compatible accessory wire guards where indicated.
- E. Manufacturers: Furnish products as indicated in Lighting Fixture Schedule included on the Drawings
- F. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Provide fixtures complying with NFPA 101.
2. Lamps: LED.
3. Directional Arrows: Universal type for field adjustment.
4. Mounting: Universal, for field selection.
5. Battery: 6 or 12 volt, nickel-cadmium type, with 1.5 hour capacity.
6. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
7. Lamps: Manufacturer's standard.

## 2.07 BALLASTS AND DRIVERS

### A. Manufacturers:

1. Alloy LED; [www.alloyled.com/#sle](http://www.alloyled.com/#sle).
2. General Electric Company/GE Lighting: [www.gelighting.com/#sle](http://www.gelighting.com/#sle).
3. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
4. OSRAM Sylvania, Inc: [www.osram.us/ds/#sle](http://www.osram.us/ds/#sle).
5. Philips Lighting North America Corporation;  
[www.usa.lighting.philips.com/#sle](http://www.usa.lighting.philips.com/#sle).
6. Or approved equal.
7. Substitutions: See Section 01 60 00 - Product Requirements.
8. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

### B. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

### C. LED Drivers:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Luminaires shall be equipped with an LED driver(s) that accepts the voltage as indicated on the Fixture Schedule on the drawings. Individual driver(s) shall be replaceable
2. Driver(s) shall be UL8750 class 2 compliant for their intended use.
3. Total harmonic distortion (THD) for current:  $\leq 20\%$ .
4. Driver(s) shall be rated to operate between -30 degrees C to 50 degrees C minimum.
5. Individual drivers shall be equipped with surge protection (6kV minimum) in accordance with IEEE/ANSI C62.4.1. Driver(s) shall be protected against damage due to either an open circuit or short circuit fault condition on the driver output.
6. Driver(s) shall have a minimum efficiency of 85 percent.
7. LED driver(s) shall have a minimum lifetime of 50,000+ hours at 40 degrees C and shall have a minimum efficiency of 80 lumens per watt.
8. LED dies shall be tested in accordance with I.E.S.N.A. LM-80-08 standards.
9. Thermal management shall be passive by design and shall consist of heat sinks with no fans, pumps, or liquids.
10. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated, without flicker.
11. Control Compatibility: Fully compatible with the dimming controls to be installed.
  - a. Wall Dimmers: See Section 26 27 26.
  - b. Daylighting Controls: See Section 26 09 23.
12. Product(s):
  - a. Lutron Hi-Lume Premier 0.1% Constant Voltage (L3D0-Series): 3-wire and digital control; 0.1 percent dimming with Soft-On and Fade-to-Black low end performance; [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - b. Lutron Hi-Lume 1% (LTE-Series): Forward phase (neutral wire required); one percent dimming; [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - c. Lutron Hi-Lume 1% (L3D-Series): 3-wire and digital control; one percent dimming; [www.lutron.com/#sle](http://www.lutron.com/#sle).



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Lutron 5-Series (LDE5-Series): Digital control; five percent dimming; [www.lutron.com/#sle](http://www.lutron.com/#sle).
- e. Lutron Hi-Lume 1% Soft-on Fade-to-Black (LDE1-Series): Digital control; one percent dimming with Soft-On and Fade-to-Black low end performance; [www.lutron.com/#sle](http://www.lutron.com/#sle).
- f. Or approved equal.

## 2.08 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Provide wire guards for lighting fixtures and equipment where indicated on the drawings.
- E. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.
  - 1. Product: As indicated in the Fixture Schedule on the drawings.
    - a. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Fire-Rated Luminaire Enclosures:
  - 1. Manufacturers:
    - a. Fire Rated Product Specialties Corp: [www.frpsonline.com/#sle](http://www.frpsonline.com/#sle).
    - b. Specialty Products & Insulation (SPI); SafeLite: [www.spi-co.com/#sle](http://www.spi-co.com/#sle).
    - c. Or approved equal.
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Provide as required to preserve fire resistance rating of building elements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.09 SPARE PARTS

- A. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 5 percent spare LED driver assemblies and light engines for each LED fixture type. LED drivers shall be turned over to the Owner's Representative in their manufacturer's protective packaging. LED drivers not in their protective packaging will not be acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Provide seismic sway bracing restraints when an installed suspended luminaire's distance from the nearest permanent object (structural, mechanical, etc.) is less than 0.707 of the total suspension cable (stem) length.
- H. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- I. Suspended Ceiling Mounted Luminaires:
1. Do not use ceiling tiles to bear weight of luminaires.
  2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
  4. Secure pendant-mounted luminaires to building structure.
  5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- J. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
  2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
  4. Install recessed luminaires to permit removal from below.
  5. Install clips to secure recessed grid supported luminaires in place. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
- K. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
  4. Install canopies tight to mounting surface.
  5. Unless otherwise indicated, support pendants from swivel hangers.
  6. Provide seismic sway bracing where indicated or as required by the application.
- L. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- M. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
- N. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- O. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- P. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- Q. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.
- R. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- S. Install accessories furnished with each luminaire.
- T. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.
- U. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 0537 using flexible conduit.
- V. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- W. Bond products and metal accessories to branch circuit equipment grounding conductor.
- X. Install specified lamps in each exit sign and luminaire.
- Y. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 23 36 00.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

Z. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

AA. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Install pendant exit signs at height indicated. Where not indicated, mount 90 inches above finished floor in space over door frame where applicable

BB. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

CC. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

DD. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- D. Operate each luminaire after installation and connection to verify proper operation.
- E. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- G. Re-lamp luminaires that have failed lamps at substantial completion.

### 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by LP Consulting Engineers, Inc..
- D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- E. Aim and adjust fixtures as indicated and/or as directed by the Architect or Electrical Engineer of Record.
- F. Position exit sign directional arrows as indicated.

### 3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean finishes and touch up damage.
- E. Clean photometric control surfaces as recommended by manufacturer.

### 3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc. or designated representative, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.09 SCHEDULE - SEE DRAWINGS

END OF SECTION 26 51 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 26 56 00  
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts and Drivers.
- C. Poles and accessories.
- D. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 26 05 00 – Common Work Results for Electrical.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 33.16 - Boxes for Electrical Systems.
- F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- G. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
  - 2. Includes lighting contactors.
- H. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.
- I. Section 26 28 13 - Fuses.
- J. Section 26 51 00 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 2013, with Editorial Revision (2022).



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing 2023.
- C. ANSI O5.1 - American National Standard for Wood Poles: Specifications and Dimensions 2022.
- D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 1989 (Corrigendum 2019).
- E. IEEE C2 - National Electrical Safety Code(R) (NEC(R)) 2023.
- F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- G. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information 2019.
- H. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- I. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- J. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities 2022.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- L. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
- M. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- N. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- O. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL 844 - Luminaires for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- Q. UL 1598 - Luminaires Current Edition, Including All Revisions.
- R. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

#### 1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect and/or District Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Coordination: Furnish bolt templates and pole mounting accessories to installer of pole foundations.

#### 1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.
3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- b. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

3. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- E. Samples:
  1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each luminaire proposed for substitution upon request.
  3. Provide one sample of each product finish illustrating color and texture upon request.
- F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
- G. Field Quality Control Reports.
  1. Include test report indicating measured illumination levels.
- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- J. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
  3. Touch-Up Paint: 2 gallons, to match color of pole finish.
- K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of CEC.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

#### 1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

### PART 2 PRODUCTS

#### 2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

#### 2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- J. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- L. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- M. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  - 1. LED Tape - General Requirements:
    - a. Listed.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Designed for field cutting in accordance with listing.
  - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
2. White LED Tape:
- a. Correlated Color Temperature (CCT): 4000 K unless otherwise indicated.
  - b. Color Rendering Index (CRI): Not less than 90.
- N. Exposed Hardware: Stainless steel.
- O. Finish: To be verified with the architect by contractor prior to ordering.

## 2.03 BALLASTS AND DRIVERS

### A. Manufacturers:

- 1. General Electric Company/GE Lighting: [www.gelighting.com/#sle](http://www.gelighting.com/#sle).
- 2. OSRAM Sylvania, Inc: [www.osram.us/ds/#sle](http://www.osram.us/ds/#sle).
- 3. Philips Lighting North America Corporation;  
[www.usa.lighting.philips.com/#sle](http://www.usa.lighting.philips.com/#sle).
- 4. Or approved equal.
- 5. Substitutions: See Section 01 60 00 - Product Requirements.
- 6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
- 7. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

### B. Ballasts/Drivers - General Requirements:

- 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
- 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- 3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

### C. Dimmable LED Drivers:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

## 2.04 POLES

### A. All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
  - a. Comply with AASHTO LTS.
  - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
    - 1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3.
  - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
  - d. Include structural calculations demonstrating compliance with submittals.
3. Material: Steel, unless otherwise indicated.
4. Shape: Square straight, unless otherwise indicated.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting Height: as indicated on the drawings.
7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
8. Unless otherwise indicated, provide with the following features/accessories:
  - a. Top cap.
  - b. Handhole, standard size.
  - c. Anchor bolts with leveling nuts or leveling shims.
  - d. Anchor base cover.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
  - f. Brackets: As required by manufacturer.
  - g. Hinged base.
  - h. Pole-top tenon, as indicated on the drawings.
- B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

## 2.05 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Poles: Per drawing.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

### 3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- H. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
  - 4. Install canopies tight to mounting surface.
  - 5. Unless otherwise indicated, support pendants from swivel hangers.
- J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- K. Pole-Mounted Luminaires:
  - 1. Maintain the following minimum clearances:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- a. Comply with IEEE C2.
  - b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
- a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
    - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
    - 2) Position conduits to enter pole shaft.
  - b. Install foundations plumb.
  - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
  - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
  - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
  - f. Install anchor base covers or anchor bolt covers as indicated.
3. Embedded Poles: Install poles plumb as indicated.
4. Grounding:
- a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
  - b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.
- L. Install accessories furnished with each luminaire.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Provide concrete bases for lighting poles at locations indicated, in accordance with detail on drawing and Section 03 3000.
- O. Install poles plumb.
  - 1. Provide shims to adjust plumb.
  - 2. Grout around each base.
- P. Install lamps in each luminaire.
- Q. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

#### 3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.
- D. Operate each luminaire after installation and connection to verify proper operation.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..
- F. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.
- G. Measure illumination levels to verify conformance with performance requirements. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

#### 3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by LP Consulting Engineers, Inc..

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc., and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 56 00

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 57 13, Erosion Control
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 12 00, Asphalt Concrete Paving.
5. Section 32 16 00, Site Concrete.
6. Section 32 80 00, Irrigation.
7. Section 32 90 00, Landscaping.
8. Section 33 40 00, Site Drainage.
9. Section 31 32 00, Soil Stabilization

1.02 SUBMITTALS

- A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or moisture content is the sole responsibility of the contractor.
- D. Tests (See Part 3 for Compaction Testing).
- E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

1.04 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.05 REFERENCES AND STANDARDS

- A. General: Site survey, included in the drawings, was prepared by Warren Consulting Engineers, dated September 9, 2023, and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.
- B. Geotechnical Engineering Report was prepared by UES. Report is entitled Matsuyama Elementary School Improvements, dated December 14, 2023, and is on file with Architect. Recommendations of the Geotechnical report were used to develop the contract plans and specifications. The Geotechnical report shall be used as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.
- C. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.
- D. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3- E. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- F. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3- G. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- H. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- I. CALTRANS Standard Specifications Section 17.
- J. CAL-OSHA, Title 8, Section 1590 (e).
- K. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.</sup></sup>

1.06 DELIVERY, STORAGE AND HANDLING

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 EXISTING SITE CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.09 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

- A. Ground-breaking requirements:
  - 1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
  - 2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.
- B. Underground Utility Locating:
  - 1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
  - 2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
  - 3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
  - 4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".
  - 5. The Underground Utility Locator Service must be able to locate but are not limited to

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

locating the following types of utility pathways:

- a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
  - b) All conduit pathways containing an active cable TV system.
  - c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
  - d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
  - e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
  - f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other "transmitter" can be applied to create a low frequency pressure wave (signal) without damaging or triggering the existing systems.
  - g) All copper or steel waterlines and plastic or steel gas lines
6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
  7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
  8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
  9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
  10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

#### 1.10 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

1.11 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.12 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.
- B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
  - 1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
  - 2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.13 ARCHEOLOGICAL AND CULTURAL RESOURCES

- A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 - PRODUCTS

Warren Consulting Engineers  
23-147C

EARTHWORK  
31 00 00 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

2.01 MATERIALS

- A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed in the upper 12 inches of any fill. Native clay or clayey soils will not be permitted within the upper 24 inches of building pad areas or paved areas.
- B. Imported Engineered Fill Material: Imported fill may be required to complete work. Proposed import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 12 or less; an Expansion Index of 20 or less; be free of particles greater than 3-inches in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.
1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
  2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory [http://www.dtsc.ca.gov/Schools/upload/SMP\\_FS\\_Cleanfill-Schools.pdf](http://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.  
Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
  3. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows;

Fill Material Sampling Schedule

| Area of Individual Borrow Area | Sampling Requirements                                 |
|--------------------------------|---|
| 2 Acres or less                | Minimum of 4 samples                                  |
| 2 to 4 Acres                   | Minimum of 1 sample every ½ Acre                      |
| 4 to 10 Acres                  | Minimum of 8 Samples                                  |
| Greater than 10 Acres          | Minimum of 8 locations with 4 subsamples per location |

Volume of Borrow Area Stockpile

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EARTHWORK  
31 00 00 - 6

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

|                                |   |
|--------------------------------|---|
| Up to 1,000 Cubic Yards        | 1 sample per 250 cubic yards  |
| 1,000 to 5,000 Cubic Yards     | 4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards     |
| Greater than 5,000 Cubic Yards | 12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards |

4. Reports/ Documentation

- a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

C. Landscape Backfill Material:

1. The top 12" of native topsoil from the site may be used for landscape backfill material provided the turf has been removed and disposed of and the top 12" has been pulverized to eliminate roots.
2. Imported Topsoil may be required to complete work. See Section 329000 for requirements. Proposed Topsoil material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

F. Decomposed Granite: Decomposed Granite shall be well graded mixture of fine to 1/8" particles in size with no clods. The material shall be free of vegetation, other soils, debris and rock. The material shall be reddish-tan to tan in color.

G. Decomposed Granite Solidifier: PolyPavement or equal.

### PART 3 – EXECUTION

#### 3.01 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

Professional Civil Engineer.

- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

A. GENERAL:

1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.
3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

- A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to (optimum) (2% above optimum) moisture content, and recompact to at least 90% of the maximum dry density.

3.04 TESTING AND OBSERVATION

- A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.
- B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.
- D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.
- E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.05 CLEARING AND GRUBBING

- A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.07, 3.08, 3.09, and 3.10. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip and dispose of the surface of all organics.

3.06 CUTTING

- A. Do all cutting necessary to bring finish grade to elevations shown on Drawings.
- B. When excavation through roots is necessary, cut roots by hand.
- C. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.

3.07 SUBGRADE PREPARATION

- A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.
- B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition to 2% above optimum moisture content and recompact to at least 90% of the maximum dry density as determined by ASTM Test Method D1557. If the existing soils are at a water content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

- C. Subgrade in areas to receive landscaping shall be compacted to 90%.
- D. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.08 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN PAVEMENT AREAS

- A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.
- B. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.
- C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.
- D. Recomposition of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6", moisture conditioned to (optimum)(2% above optimum) moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.
- E. Jetting of fill materials will not be allowed.

3.09 FINAL SUBGRADE COMPACTION

- A. Paved Areas: Upper 6" of all final subgrades supporting pavement sections and all other flatwork shall be brought to specified moisture content and shall be uniformly compacted to not less than 95% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
  - 1. Exception; in lime /cement treated areas the upper 12" shall be compacted to 95% Compaction.
- B. Other Fill and Backfill: Upper 12" of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- C. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.10 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

- A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 12" at 85% of maximum dry density.
- B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 SLOPE CONSTRUCTION

- A. Cut slopes shall be constructed to no steeper than 2:1 (horizontal:vertical). Fill slopes shall be constructed to no steeper than 2:1 (horizontal:vertical).

3.13 FINISH GRADING

- A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be "flat graded" to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be  $\pm 0.05'$ . Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.
- B. All landscape areas shall be left free of rock or foreign material as specified in Section 32 90 00.
- C. All landscape areas shall be approved by Architect prior to any planting.

3.14 SURPLUS MATERIAL

- A. Excavated material not required for grading or backfill shall be removed from site at contractor's expense.

3.15 CLEANING

- A. Refer to Section 01 74 00.
- B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 57 13, Erosion Control
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 12 00, Asphalt Concrete Paving.
5. Section 32 16 00, Site Concrete.
6. Section 32 80 00, Irrigation.
7. Section 32 90 00, Landscaping.
8. Section 33 40 00, Site Drainage.
9. Section 31 32 00, Soil Stabilization

1.02 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

1.03 SUBMITTALS

- A. Submit Manufacturers data and shop drawings.

1.04 REFERENCES AND STANDARDS

- A. California Building Code current edition.
- B. California Plumbing Code current edition.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.06 PROJECT CONDITIONS

- A. Contractor shall acquaint himself with all existing site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Field verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.
- C. Trench dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for trench dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.07 PROTECTION

- A. Adequate protection measures shall be provided to protect workers and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations. Repair all trenches in grass areas with new sod (seeding not permitted) and "stake-off" for protection.
- B. Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Architect or Owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. Keep all excavations free from water during entire progress of work, regardless of cause, source or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.
- H. Trees: Carefully protect existing trees which are to remain.

1.08 TRENCH SAFETY PROVISIONS

- A. General Contractor shall be solely responsible for safety design, construction and coordination with agencies having jurisdiction. If such plan varies from shoring system standards established by Construction Safety Orders, plan shall be prepared by registered civil or structural engineer.
- B. Nothing herein shall be deemed to allow use of shoring, sloping or protective system less effective than that required by Construction Safety Orders of California State Division of Industrial Safety.
- C. When trenching through paved surface, provide steel trench plates to cover open trenches daily until trenches are backfilled.

1.09 SEASONAL LIMITS

- A. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, full operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Material above optimum moisture shall be processed per section 310000, 3.08, B.

1.10 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
  1. ¾ inch crush rock.
  2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than 3-inches.
  3. Sand: Fine granular material, free of organic matter, mica, loam or clay.
  4. Lean Mix Concrete/Controlled Density Backfill: 2 sacks cement slurry.
  5. Class 2 aggregate base, ¾" rock, per Caltrans section 26-1.02B

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- C. Provide other bedding and backfill materials as described and specified in Section 31 00 00 and Section 33 40 00.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verification of Conditions:
  - 1. Examine areas and conditions under which work is to be performed.
  - 2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.02 COORDINATION

- A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 INSTALLATION

- A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.04 TRENCHING

- A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.
- B. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.
- C. Trench straight and true to line and grade with bottom smooth and free of edges or rock points.
- D. Where depths are not shown on the plans, trench to sufficient depth to give minimum fill above top of installed item measured from finish grade above the utility as follows:
  - 1. Sewer pipe: depth to vary
  - 2. Storm drain pipe: depth to vary
  - 3. Water pipe - Fire Supply: 36 inches
  - 4. Water pipe – Domestic Supply: 30 inches

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- E. Where trench through existing pavement saw cut existing pavement in straight lines. Grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new asphalt. Replace asphalt and concrete pavement sections to matched existing conditions. In concrete pavement provide expansion and control joints to match existing joint layout.

3.05 BACKFILL

- A. Pipe Trench Backfill is divided into three zones:
  - 1. Bedding: Layer of material directly under the pipe upon which the pipe is laid.
  - 2. Pipe Zone: Backfill from the top of the bedding to 6 inches (compacted) over the top of the pipe.
  - 3. Upper Zone: Backfill between top of Pipe Zone and to surface of subgrade.
- B. Bedding: Type of material and degree of compaction for bedding backfill shall be as defined in the Details and Specifications.
- C. Pipe Zone and Upper Zone Backfill:
  - 1. Type of material and degree of compaction Pipe Zone and Upper Zone Backfill shall be as required by Drawings, Details, & Specifications.
  - 2. Upper Zone Backfill shall not be placed until conformance of Bedding and Pipe Zone Backfill with specified compaction test requirements has been confirmed.
  - 3. Backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced. Material shall not be dropped directly on pipe.
- D. Backfill Compaction:
  - 1. Backfill shall be placed in layers which, when compacted shall not exceed 6 inches in thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity. Do not backfill over, wet, frozen or soft subgrade surfaces. Employ a placement method that does not disturb or damage foundation walls, perimeter drainage, foundation damp-proofing, waterproofing or protective cover.
  - 2. When moisture content of fill material is below that required to achieve specified density, add water until proper moisture content is achieved. When moisture content is above that required, aerate by blading or other methods until specified moisture content is met, see section 310000, 3.08, B.
  - 3. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to 90% of maximum dry density while at specified moisture content. Compact each layer over its entire area until desired density has been obtained.
  - 4. The top 6 inches of subgrade compaction under pavement shall be per Earthwork section 31 00 00.
  - 5. Compaction: All backfill operations shall be observed by the Inspector of Record and/or Geotechnical Engineer. Field density tests shall be made to check compaction of fill material. If densities are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

specified densities. Notify Inspector and Architect at least 24 hours in advance of any operation.

- E. Backfill in Areas Previously Lime or Cement Treated
  - 1. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base, with minimum section equal to the lime treated section and compacted to 95%.

3.06 TRENCH AND SITE RESTORATION

- A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.07 PROTECTION

- A. Protect existing surfaces, structures, and utilities from damage. Protect work by others from damage. In the event of damage, immediately repair or replace to satisfaction of Owner.
- B. Repair existing landscaped areas to as new condition. Replant trees, shrubs or groundcover with existing materials if not damaged or with new materials if required. Replace damaged lawn areas with sod, no seeding will be permitted.
- C. Replace damaged pavement with new compatible matching materials. Concrete walks to be removed to nearest expansion joint and entire panel replaced. Asphalt to be cut neatly and replaced with new materials.
- D. Any existing materials removed or damaged due to trenching to be returned to new condition.

3.08 SURPLUS MATERIAL

- A. Remove excess excavated material, unused materials, damaged or unsuitable materials from site.

3.09 CLEANING

- A. Refer to Section 01 74 00.
- B. Contractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others throughout the project and at the completion of work.
- C. After completion of work in this section, remove all equipment, materials, and debris. Leave entire area in a neat, clean, acceptable condition.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

SECTION 31 32 00 - SOIL STABILIZATION

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Description: Provide Lime Stabilization Treatment, including spreading and mixing lime and water with in-place materials, and compacting the mixture to the lines, grades and dimensions shown on the plans and/or specified.

B. RELATED SECTIONS

1. The General Conditions and Supplementary Conditions are fully applicable to this Section, as if repeated herein.
2. Section 31 23 33, Trenching and Backfilling.
3. Section 32 12 00, Asphalt Concrete Paving.
4. Section 32 16 00, Site Concrete.

1.02 SUBMITTALS

A. QUALITY ASSURANCE

1. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
2. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
3. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
4. Tests (See Part 3 for Compaction Testing).
5. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.
6. Failures due to the lack of continuous moisture control during the curing period will be the sole responsibility of the contractor.
7. Any trenching through the finished cured lime/cement section will result in the contractor having to backfill trench with class 2 aggregate base rock, or cement/sand slurry,

1.03 SUBMITTALS

1. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

guarantee, installation instructions, and maintenance instructions

1.04 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.05 QUALITY ASSURANCE

- A. General: All Quality Assurance procedures specified on the drawings shall apply to this Section in addition to those shown below.
- B. Testing:
0. Geotechnical Engineer: Owner is retaining a Geotechnical engineer to determine compliance of Lime Stabilization Treatment with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except that costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
- C. Inspection: Work shall not be performed without the physical presence and approval of Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two working days prior to commencement of any aspect of site earthwork.
- D. Field Density: Field density and phenolphthalein reaction tests shall be made by the Geotechnical Engineer after completion of compaction. Where compaction equipment has disturbed the surface to a depth of several inches, density tests shall be taken in the compacted material below the disturbed surface.

1.07 SUBMITTALS

- A. Weighmaster Certificates: Provide certificates as required in Section 2.01B.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lime Treated Engineered Fill: The materials to be treated shall consist of on-site soils or approved import material as described in Section 31 00 00.
- B. Lime: Lime in areas to be treated shall be lime. The percentage of lime shall be based on a soil weight of 100 pcf; hence, 5 pounds lime should be utilized per square foot. A certification of compliance shall be submitted to the Geotechnical Engineer with each delivery of lime.
- C. Water: Water shall be added during the preliminary mixing operations and, if necessary, during final mixing and to keep the cured material moist until curing is complete. The



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

amount of water added shall be subject to the approval of the Geotechnical Engineer at all times.

PART 3 - EXECUTION

3.01 PREPARATION

- A. General: Layout all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection facilities; all prior to beginning actual earthwork operations.

3.02 EQUIPMENT

- A. Lime Spreader: The lime shall be spread by equipment which shall uniformly distribute the required amount of lime. The rate of spread per square foot of blanket shall not vary more than 5 percent from the designated rate, unless otherwise approved by the Geotechnical Engineer.
- B. Mixing Equipment: Mixing equipment shall be capable of mixing or remixing the materials to a uniform mixture free of streaks or pockets of lime to the full required depth.

3.03 START OF WORK UNDER THIS SECTION

- A. General: Prior to starting physical work under this Section, the property line is to be clearly staked and identified. No lime treated materials shall be allowed to contaminate areas outside of the property.
- B. Utilities; Contractor is to engage with a licensed contractor specialized in the Utility Locating Business. The contractor shall locate any and all utilities and pothole the same. The frequency of potholing shall be enough to establish the elevations of all utilities located.

3.04 LIME SPREADING

- A. Engineered Fill: Provide lime treatment in areas shown on plans and extending a minimum distance of 2 feet from outside edge of curb, building footing, wood header, and to a depth of at least 12-inches.
- B. Temperature: Lime shall not be spread while the atmospheric temperature is below 35 degrees Fahrenheit or when conditions indicate that the temperature may fall below 35 degrees Fahrenheit within 24 hours.

3.05 MIXING

- A. Lime shall be added to the material to be treated at a rate of 5 pounds lime per square foot based on a soil unit weight of 100 pcf.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Lime shall be spread by equipment that will uniformly distribute the required amount of lime for the full width of the prepared material. The rate of spread per linear foot of blanket shall not vary more than five percent (5%) from the designated rate.
- C. The spread lime shall be prevented from blowing by suitable means selected by the Contractor. Quicklime shall not be used to make lime slurry. The spreading operations shall be conducted in such a manner that a hazard is not present to construction personnel or the public. All lime spread shall be thoroughly mixed into the soil the same day lime spreading operations are performed.
- D. The distance which lime may be spread upon the prepared material ahead of the mixing operation will be determined by the Geotechnical Engineer.
- E. No traffic other than the mixing equipment and water truck will be allowed to pass over the spread lime until after the completion of mixing. After mixing, grading and compacting are completed, only the water truck is allowed on the treated area to maintain the optimum moisture for curing.
- F. Mixing equipment shall be equipped with a visual depth indicator showing mixing depth, an odometer or footmeter to indicate travel speed and a controllable water additive system for regulating water added to the mixture.
- G. Mixing equipment shall be of the type that can mix the full depth of the treatment specified and leave a relatively smooth bottom of the treated section. Mixing and re-mixing, regardless of equipment used, will continue until the material is uniformly mixed free of streaks, pockets, or clods of lime), and moisture is at approximately two percent (2%) over optimum and the mixture complies with the following requirements:

| <u>Minimum<br/>Sieve Size</u> | <u>Percent Passing</u> |
|-------------------------------|------------------------|
| 1-1/2"                        | 100                    |
| 1"                            | 95                     |
| No. 4                         | 60                     |

Non-uniformity of color reaction when the treated material, exclusive of one inch or larger clods, as tested with the standard phenolphthalein alcohol indicator, will be considered evidence of inadequate mixing.

- H. Lime -treated material shall not be mixed or spread while the atmospheric temperature is below 35°F. The entire mixing operation shall be completed within seventy-two (72) hours of the initial spreading of lime, unless otherwise permitted by the Geotechnical Engineer.

### 3.06 SPREADING AND COMPACTING

- A. The treated mixture shall be spread to the required width, grade and cross-section. The maximum compacted thickness of a single layer may be determined by the Contractor

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

provided he can demonstrate to the Geotechnical Engineer that his equipment and method of operation will provide uniform distribution of the lime and the required compacted density throughout the layer. If the Contractor is unable to achieve uniformity and density throughout the thickness selected, he shall rework the affected area using thinner lifts until a satisfactory treated subgrade meeting the distribution and density requirements is attained, as determined by the Geotechnical Engineer, at no additional cost to the Owner.

- B. The finished thickness of the lime-treated material shall not vary more than five hundredths of a foot (0.05') from the planned thickness at any point.
- C. The lime -treated soils shall be compacted to a relative compaction of not less than 95 percent (95%) as determined by the ASTM D1557-01 Compaction Test.
- D. Initial compaction shall be performed by means of a sheepsfoot type roller or a vibratory padfoot roller. Final rolling shall be by means of a smooth drum roller.
- E. Areas inaccessible to rollers shall be compacted to meet the minimum compaction requirement by other means satisfactory to the Geotechnical Engineer.
- F. Final compaction shall be completed within thirty-six (36) hours of final mixing. The surface of the finished lime -treated material shall be the grading plane and at any point shall not vary more than five hundredths of a foot (0.05') foot above or below the grade established by the plans.
- G. Before final compaction, if the treated material is above the grade tolerance specified in this section, uncompacted excess material may be removed and used in areas inaccessible to mixing equipment. After final compaction and trimming, excess material shall be removed and disposed of off site. The trimmed and completed surface shall be rolled with steel or pneumatic-tired rollers. Minor indentations may remain in the surface of the finished materials so long as no loose material remains in the indentations.
- H. At the end of each day's work, a construction joint shall be made in thoroughly compacted material and with a vertical face. After a part-width section has been completed, the longitudinal joint against which additional material is to be placed shall be trimmed approximately three inches (3") into treated material, to the neat line of the section, with a vertical edge. The material so trimmed shall be incorporated into the adjacent material to be treated.
- I. An acceptable alternate to the above construction joints, if the treatment is performed with cross shaft rotary mixers, is to actually mix three inches (3") into the previous day's work to assure a good bond to the adjacent work.

### 3.07 FINAL GRADING

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- A. Finish all lime treated engineered fill grades to within a tolerance of 0.05' of grades shown for top of lime stabilization treatment or as indicated by drawings and specifications.
- B. Leave all areas in suitable condition for subsequent work.
- C. Excess materials not needed for final grading operations shall be removed from the site.

3.07 CURING

- A. The surface of compacted and finish graded lime treated soil shall be kept moist for at least 3 days after final trimming, rolling and compacting. No equipment or traffic shall be permitted on the lime treated material during the 3 day cure, except for the water truck to keep the treated area at or above the optimum moisture. After the 3 day cure apply aggregate base. Maintain moisture curing at optimum level until aggregate base is placed.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

SECTION 32 12 00 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Asphalt paving mix designs.
2. Aggregate Base Course.
3. Asphalt Overlay.
4. Seal Coat and Striping.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 310000, Earthwork.
4. Section 313200, Soil Stabilization.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.
- E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.
- F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.
- G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

1.04 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.06 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements:

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees F.
  2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- C. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- D. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- E. Any construction review of the Contractor's performance conducted by the owner's representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- F. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- G. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- H. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
- I. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- 1.09 TESTING
- A. General: Refer to Section 01 40 00 – Quality Requirements.
- B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sterilant: Soil sterilizer shall be CIBA GEIGY's Pramitol 25-E or Thompson-Hayward Casoron.
  - 1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.
- B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).
- C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturer's.
- D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.
- E. Surface Course Aggregate: Mineral aggregates for Type "B" asphalt concrete, conforming to State Specifications 39-2.02, Type B, 1/2" maximum, medium grading. 3/8" maximum grading at Playcourt.
- F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:
  - 1. "Park-Top No. 302", Western Colloid Products.
  - 2. "OverKote", Reed and Gram.
  - 3. "Drivewalk", Conoco Oil.
- G. Wood Headers and Stakes: Pressure treated.
- H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.
  - 1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
  - 2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.
- I. Precast Concrete Bumpers: 3000 psi at 28 day minimum strength; 48" length unless otherwise indicated; provide with steel dowel anchors and concrete epoxy.
- J. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.
- K. Crack Filler;
  - 1. Cracks up to 1/2": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

- Trowel Grade crack filler or approved equal.
- 2. Cracks ¼" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
- 3. Cracks greater than 1": Hot Mix, Topeka.

- L. Reclaimed Asphalt Paugment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% of the aggregate blend.

## 2.02 MIXES

- A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.
- B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.
- C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.
- D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.
- E. Temperature of Warm Mix Asphalt: Mixing and placement; Per the approved manufactures heat range recommendations for mixing and placement.

## PART 3 - EXECUTION

### 3.01 EXAMINATION OF CONDITIONS

- A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

### 3.02 PREPARATION

- A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.
- B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

with a strong jet of water to remove all debris.

3.03 INSTALLATION

A. Headers:

1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.
3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header so they will not be visible on completion of job.

B. Asphalt Paving:

1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.
  - a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.
2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Surface Course:
  - a. Comply with State Specifications, 39-6 except as modified below.
    - 1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.
    - 2) Asphalt material shall be delivered to the project site in a covered

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.

5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.
6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3" wide x 1/2 the depth of the section. Apply tack coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

C. Seal Coat:

1. Seal coat shall be applied no sooner than 30 days from time of asphalt placement, no exceptions.
2. Surface Preparation: surface and cracks shall be clean of all dirt, sand, oil or grease. All cracks shall be filled to a level condition after curing. Make multiple fill applications until a level condition is achieved. Failure to do so will be the reason for rejection. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt concrete to full depth of damage and replace with compacted hot mix asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.
3. Seal Coat Seal Application: Thoroughly mix materials and apply in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
  - a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
  - b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

D. Asphalt Concrete Overlay Paving:

1. Comply with State Specifications, 39-6 except as modified below.
2. Grind or remove existing asphalt concrete paving at limits of overlay paving to provide a minimum 1 1/2" overlay thickness. Limits of grinding or removal shall be field verified to insure that finished paving surface will have a one percent minimum slope.
3. Thoroughly clean surface to remove vegetation, dirt, sand, gravel and water from

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

- surface and from cracks. Vegetation shall be treated 7 days prior to removal with an herbicide.
4. Cracks greater than 1 inch shall be filled with hot mix asphalt and rolled and compacted. Cracks less than one inch shall be filled with crack filler. Potholes shall be filled with hot-mix rolled and compacted. Contractor shall have Engineer approve crack and pothole repair prior to overlay. Provide leveling courses of hot mix asphalt as required to achieve finish grades shown on the drawings.
    - a. Cracks less than one inch in width shall be level after curing. Contractor shall make multiple filling applications as necessary to achieve a level condition.
  5. Place overlay when ambient air temperature is 40 degrees F. and rising, and when pavement is dry.
  6. An asphalt tack coat shall be applied to existing surface area at a rate of 0.20 gallons per square yard. Application width shall be width of fabric plus 2 to 6 inches.
  7. Place, spread and compact asphalt overlay to provide a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method #304. Maximum variation 1/8" in 10' when measured with steel straight edge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. Minimum compacted overlay thickness 1 1/2 inches.
- E. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).
1. Paints shall be delivered to the site in unopened containers.
    - a. Paint shall not be diluted, or watered down.
    - b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
  2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to PMS 293C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.
- F. Colors: As directed by Architect

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

- G. Precast Concrete Bumpers: Install in location where shown, using steel rebar dowels, and epoxy.

3.04 DEFECTIVE ASPHALT;  
Defective asphalt is as described below.

- A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.
- B. Asphalt not placed to the design grades.
- C. Asphalt that ponds water.
- D. Asphalt that was compacted below the minimum required temperature and is cracked.
- E. Asphalt that fails to meet the minimum compaction requirements.
- F. Asphalt that lacks the minimum thickness required per plan.
- G. New asphalt contaminated by a petroleum product, or spilled paint.
- H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,
- I. Asphalt placed on pumping, unstable sub-grades.

3.05 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

SECTION 32 16 00 - SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural or non-vehicular applications.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 310000, Earthwork.
3. Section 313200, Soil Stabilization.

1.02 REFERENCES AND STANDARDS

- A. California Building Code, latest edition.
- B. ACI Standards, ACI 318-19.
- C. ASTM C-94, Specification for Ready-Mixed Concrete.
- D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).
- E. ASTM – American Society for Testing and Materials.

1.03 SUBMITTALS

- A. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- B. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.
- C. With concrete submittal, provide documented history of mix design performance.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Use materials and products of one manufacturer whenever possible.
- C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.
- B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.
- C. Transport, store and handle in strict accord with the manufacturer's written recommendations.
- D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.
- E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.
- F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.06 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.07 TESTING

- A. General: Refer to Section 01 40 00 – Quality Requirements.
- B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.08 ADEQUACY AND INSPECTION

- A. Design, erect, support, brace and maintain formwork and shoring to safely support all

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

vertical and lateral loads that might be applied until such loads can be carried by concrete.

- B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.09 PROTECTION

- A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.10 FIELD MEASUREMENTS

- A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-19 Section 26.4.
- B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.
- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-19.
- D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.
- E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-19. Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.
- F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-19.
- G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.
- I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.
- J. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3'-0" O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3" concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.
- K. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; "Armor-Tile", "Access Tile Tactile Systems", or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35"). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).
- L. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.
- M. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.
- N. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.
- O. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.
- P. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.
- Q. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.
- R. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
  - 1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
  - 2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
  4. Color: Custom color as selected by Architect.
- S. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or an approved equal.
- T. Adhesive Anchoring (Epoxy): Simpson Strong-Tie SET-XP, or approved equal.

2.02 CONCRETE DESIGN AND CLASS

- A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.
- B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".
- C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.
- D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.03 MIXING OF CONCRETE

- A. Conform to requirements of CBC, Chapter 19A.
- B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.
- C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA.
  1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
  2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
  3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

4. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
6. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.04 MATERIALS TESTING

- A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Sections 1704A.4.4 when approved by Structural Engineer and DSA.
- B. Testing of concrete shall be performed per article 3.12 of this specification.

2.05 EQUIPMENT

- A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.01 APPROVAL OF FORMS AND REINFORCEMENTS

- A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.
- B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.
- C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.
- D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
  1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.02 PROTECTION

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.
- C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.03 CLEANING

- A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.
- B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.04 FORMING

- A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.
- B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.
- C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.
- D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.
- E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

construction joints.

- F. Slope tie-wires downward to outside of wall.
- G. Brace, anchor and support all cast-in items to prevent displacement or distortion.
- H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.
- I. Concrete paving, Curbs, Curb and Gutters, Ramps:
  - 1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed  $\frac{1}{4}$  inch depth measured from finish surface to top of felt or sealant, and  $\frac{1}{2}$  inch width.
  - 2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
  - 3. Isolation Joints:  $\frac{3}{8}$ " felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
  - 4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
  - 5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
    - a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
    - b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

### 3.05 FORM COATING

- A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.
- B. Before re-using form material, inspect, clean thoroughly and recoat.
- C. Seal all cut edges.

### 3.06 INSTALLATION

- A. General: Reinforcement shall be accurately placed at locations indicated on the drawings

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.

B. Placing Tolerances:

1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.

C. Splices:

1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
  - a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
  - b. All splices shall be staggered at 5 feet minimum.

3.07 INSPECTION

- A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.
- B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.08 PLACING OF CONCRETE

- A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.
- B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

reinforcing steel.

- C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.
- D. Remove form spreaders as placing of concrete progresses.
- E. Place footings as monolithic and in one continuous pour.
- F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.
- G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.
- H. Concrete Flatwork:
  - 1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10' for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.
  - 2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
  - 3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
- I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.
- J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.
- K. Horizontal construction joint: Keep exposed concrete face of construction joints

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.09 CONCRETE FINISHES

- A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
  2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
  3. Under no circumstances can water be added to the top surface of freshly placed concrete.
- B. Curb Finishing: Steel trowel.
- C. Joints and Edges: Mark-off exposed joints, where indicated, with 1/4" radius x 1" deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.
1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.
- D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

- E. Stair Treads and Risers: Tool exterior stair tread nosing per ADA requirements and as detailed. Paint or stain tooled area at every stair tread nosing or as detailed. Stair tread nosing shall contain no pockets, voids or spalls. Patching is not allowed. Damaged nosing shall be replaced.

### 3.10 CURING

- A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.
- B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.
  - 1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.
- C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

### 3.11 DEFECTIVE CONCRETE

- A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.
- B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.
- C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.
- D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- E. Defective concrete is:
1. Concrete that does not match the approved mix design for the given installation type.
  2. Concrete not meeting specified 28-day strength.
  3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
  4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
  5. Concrete containing embedded wood or debris.
  6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
  7. Concrete not containing required embedded items.
  8. Excessive Shrinkage, Traverse cracking, Cracking, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
  9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
  10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
  11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
  12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
  13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.
- F. Patching: Install specified Patching Mortar per manufacturer's recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

- A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.
- B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.
- C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.
- F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

- A. Remove without damage to concrete surfaces.
- B. Sequence and timing of form removal shall insure complete safety of concrete structure.
- C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
  - 1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
  - 2. Slab edge screeds or forms: 7 days.
  - 3. Concrete columns and beam soffits: 28 days.
- D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.
- D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 32 17 25 - PAVEMENT COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Paint coatings applied to asphalt paving.

B. Related Sections:

1. Division 01 sustainable design requirements Section(s) for supplementary sustainable design criteria.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to coating asphalt paving including, but not limited to, the following:
  - a. Review requirements for protecting pavement coatings, including restriction of traffic during installation period.

1.03 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

B. Shop Drawings:

1. Indicate pavement coatings, colors, and dimensions to adjacent work.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.04 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Documentation for paints and coatings, indicating VOC content.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement coating only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. GAF.
- B. Source Limitations: Obtain pavement-coating paints from single source from single manufacturer.

2.02 SUSTAINABLE DESIGN CRITERIA

- A. Sustainable Design Criteria: Comply with indicated criteria for the following product categories:
  - 1. Paints and Coatings:
    - a. VOC content limits for field applications.

2.03 PERFORMANCE REQUIREMENTS

- A. Slip Resistance, Coefficient of Friction: Provide products with the following values as determined by testing identical products in accordance with the following:
  - 1. Level Surfaces, Dry and Wet: DCOF of not less than 0.55 in accordance with ANSI A326.3.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and California Building Code, Chapter 11.

2.04 PAVEMENTCOATING SYSTEM

- A. Pavement Coating System: Two-component advanced waterborne epoxy-modified acrylic.
  - 1. Basis-of-Design Coating System: GAF; Streetbond SB150 Pavement Coating.
    - a. Number of Coats: 4.
    - b. Colorant: StreetBond Solar Reflective (SR).
  - 2. Colors: As indicated on drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that pavement substrate is dry and in suitable condition to begin pavement coating in accordance with manufacturer's written instructions.

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Proceed with pavement coating only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

- A. Do not apply pavement-coating paint until layout, colors, and placement have been verified with Architect.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce pavement coatings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates.

3.03 PROTECTING AND CLEANING

- A. Protect pavement coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

SECTION 32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:  
1. Unitary, seamless surfacing.

1.02 DEFINITIONS

- A. Definitions in ASTM F2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of protective surfacing.  
1. Include plans, sections, placement and penetration details, and attachment to substrates.  
2. Include accessories and edge terminations.  
3. Include fall heights and use zones for equipment and structures specified in Section 11 68 00 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.
- C. Samples for Verification: For each type of protective surfacing and exposed finish.  
1. Unitary, Seamless Surfacing: Minimum 6 by 6 inches.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

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PLAYGROUND PROTECTIVE  
SURFACING  
32 18 16.13 - 1

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.
  - 1. Build mockups for protective surfacing including accessories.
    - a. Size: 48 inches by 48 inches.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Reduction in impact attenuation as measured by reduction of critical fall height.
    - b. Deterioration of protective surfacing and other materials beyond normal weathering.
  - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials from single source from single manufacturer.
  - 1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.02 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

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PLAYGROUND PROTECTIVE  
SURFACING  
32 18 16.13 - 2



MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

2.03 UNITARY, DUAL-DENSITY, SEAMLESS SURFACING

- A. Description: Manufacturer's standard, site-mixed and applied, two-layer material with wearing layer over cushioning layer, with combined, overall thickness as required, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Surface America; Playbound or a comparable product by one of the following:
    - a. Child Safe Products, Inc.
    - b. Fibar Group LLC (The).
    - c. GameTime; a PlayCore Company.
    - d. Hanover Specialties, Inc.
    - e. Landscape Structures Inc.
    - f. No Fault LLC.
    - g. Playsafe Surfacing LLC.
    - h. SpectraTurf, Inc.
  2. Wearing Layer: Formulation of EPDM rubber particles, binder, and other organic and inorganic components.
  3. Cushioning Layer: Formulation of recycled SBR particles and binder.
  4. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane.
  5. Topcoat: Manufacturer's standard polyurethane-based formulation.
  6. Critical Height: As indicated on Drawings.
  7. Overall Thickness: Not less than as required for critical height indicated.
  8. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location.
  9. Wearing Layer Color(s): As selected by Architect from manufacturer's full range.
    - a. Design: Where colored pattern is required, provide as indicated on Drawings.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy- or polyurethane-based formulation suitable for exterior use and approved by protective surfacing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

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PLAYGROUND PROTECTIVE  
SURFACING  
32 18 16.13 - 3

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
  - 1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.
  - 2. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.
- B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
  - 1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
  - 2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.

### 3.03 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
  - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
  - 2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
  - 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.

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PLAYGROUND PROTECTIVE  
SURFACING  
32 18 16.13 - 4

MATSUYAMA ELEMENTARY SCHOOL MODERINZATION  
SACRMANETO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
04 JANUARY 2024

4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
  - a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
5. Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.04 PROTECTION

- A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION

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PLAYGROUND PROTECTIVE  
SURFACING  
32 18 16.13 - 5

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

SECTION 32 18 23.39 - SYNTHETIC TRACK SURFACING

PART 1 – GENERAL

1.01 Scope

The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of a 13mm (minimum) Non-permeable Synthetic Track Surfacing System and related work indicated on the drawings and specified herein.

The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1.02 Specific Scope of Work

- A. Install an IAAF approved, impermeable polyurethane synthetic track system consisting of a combination of SBR Rubber and polyurethane binders and two-component U.V. stabilized elastomeric polyurethane wearing layer with an encapsulated textured finish.

1.03 Coordination

The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

PART 2 – CODES AND STANDARDS

2.01 Applicable Publications

Codes and standards follow the current guidelines set forth by the International Amateur Athletic Federation (IAAF) and the National Collegiate Athletic Association (NCAA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

2.02 Performance Standards

The Synthetic track surfacing system shall exhibit the following minimum performance standards as required by IAAF:

- A. Thickness > 13mm
- B. Force Reduction 35 to 50%

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

- C. Modified Vertical Deformation 0.6 to 1.8mm
- D. Friction > 47 TRRL Skid Resistance
- E. Tensile Strength > 0.5MPa
- F. Elongation at Break > 40%

### PART 3 – QUALITY ASSURANCE

#### 3.01 Contractor Qualifications

- A. The CONTRACTOR must have a minimum of 5 years experience in the installation of the track surfacing system selected and proposed.
- B. The CONTRACTOR shall be able to furnish evidence that they have been in business for a period of not less than 5 years, under the present name, and if required, furnish financial statements for each of the past 5 years.
- C. The CONTRACTOR shall also be required to have a full time employee on staff with a “Certified Track Builder (CTB)” designation as awarded by the American Sports Builder’s Association. A current CTB certificate shall be included with the bid package for this project.
- D. The CONTRACTOR is required to provide documentation that shows the selected specified and installed product meets IAAF Performance Specification for Synthetic Surfaced Athletics Tracks (Outdoor) and is certified in terms of the IAAF certification system as updated to present day.
- E. The CONTRACTOR is to provide a list of completed facilities, minimum of 10 outdoor track facilities using the system specified herein with the contractor bidding this project.
- F. The CONTRACTOR shall have 10 years experience with the aliphatic coating.
- G. The MANUFACTURER must have a minimum of 10 years of experience with compound athletic surfaces.
- H. The MANUFACTURER must offer a minimum of four (4) IAAF Certified Track Systems.

#### 3.02 Submittals

The following submittals must be received with the bid submittal:

- A. Standard printed specifications of the synthetic track surfacing system to be installed on this project.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

- B. An affidavit attesting that the synthetic track surfacing material to be installed meets the requirements defined by the manufacturers currently published specifications and any modifications outlined in those technical specifications.
- C. A synthetic track surfacing system sample, 6" x 6" in size, of the same synthetic track surfacing system to be installed on this project.
- D. An installation list of outdoor track facilities installed within the last two years, using the exact synthetic track surfacing system specified herein.
- E. Test results from an approved IAAF Testing Laboratory confirming compliance to the performance of athletic tracks test according to the IAAF.

#### PART 4 - MATERIALS

##### 4.01 Elastomeric Polyurethane

- A. Two-component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent (100%) Methylene Diphenyl Isocyanate (MDI). No Toluene Diisocyanate Isocyanate (TDI) will be allowed.
- B. The elastomeric polyurethane shall be red in color.

##### 4.02 EPDM Granulate

- A. The EPDM granulates shall be 1 to 3mm in size and peroxide cured.
- B. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

##### 4.03 Rubber Granulate of the base course

- A. Styrene Butadiene Rubber (SBR) processed ground to a graded size of 1- 3mm.
- B. A maximum of 82%, by weight of the paved-in-place base layer, of SBR will be allowed.

##### 4.04 Single Component Polyurethane Binder

- A. A single-component polyurethane binder with a long cure time for use in paved mat specifications. A minimum of 18%, by weight of the paved-in-place base layer.

##### 4.05 Seal Coat

- A. A two-component polyurethane pore sealer use with paved rubber granule mats. The

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

granular SBR and binder layer shall be sealed with elastomeric polyurethane. The application of EPDM dust is not allowed.

4.06 Aliphatic Coating

- A. Single Component moisture cured aliphatic coating.
- B. Aliphatic Coating shall be read in color matching the UV stabilized elastomeric polyurethane.
- C. No clear or two component coatings will be allowed.

4.07 Line Marking Paint

Single-component, moisture cured, aliphatic polyurethane paint.

PART 5 - INSTALLATION

5.01 Subbase

The Synthetic Track Surfacing System shall be laid on an approved subbase. The General Contractor shall provide compaction test results of 95% or greater for the installed subbase and asphalt surface.

The track surface shall not vary from planned cross slope by more than +/- 0.2%, with a maximum lateral slope outside to inside of 1.8%, and a maximum slope of 4.5% in any running direction. The finished substrate shall not vary under a 10' straight edge more than 1/8".

Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed, either by chipping out paving or removing and replacing with new.

It shall be the responsibility of the surfacing contractor to determine if the substrate has cured sufficiently prior to the application of polyurethane surfacing system.

It shall be the responsibility of the general contractor to determine if the substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work can commence.

5.02 Thickness

The thickness of the Encapsulated Synthetic Track Surfacing System shall be 13mm.

5.03 Equipment

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

The Encapsulated Synthetic Track Surfacing System components shall be processed and installed by specially designed machinery and equipment. A mechanically operated paver with variable regulated speed and thermostatically controlled screed shall be used in the installation of the base mat. The wearing course shall be installed using automatic electronic portioning, which provides continuous mixing and feeding for an accurate, quality controlled installation, Unless approved otherwise by Owner and Engineer.

5.04 Installation

- A. Base Course: The SBR granules and polyurethane binder shall be mixed together on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The binder shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver.
- B. Seal Coat: The polyurethane sealer components are mixed at the prescribed ratio homogeneously with a suitable mixing device. The coating is squeegee applied to the base mat, making it impermeable.
- C. Wearing Course: The 1 to 3mm EPDM granules shall be integrated into the sealer to achieve the full depth of the 5 mm wearing course. The resilient embedded textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course.
- D. Protective Coating: The initial red pigmented aliphatic polyurethane coating shall be spray applied over the entire synthetic surfaced area at a rate of 150-175 square feet per gallon. The second red pigmented aliphatic polyurethane coating shall be spray applied over the initial application at a rate of 150-175 square feet per gallon in the opposite direction.

5.05 Site Conditions

- A. Installation shall not take place if adjacent or concurrent construction generates excessive dust, abrasives or any other by-product that, in the opinion of the installer, would be harmful to the track material, until completion of such works.
- B. If, in the opinion of the installer of the synthetic material, the weather and/or climatic conditions are detrimental to the proper installation of the surfacing materials, work shall be delayed until conditions are acceptable. Preferred installation temperature is fifty degrees Fahrenheit and rising. Installation shall be executed only in dry conditions.

PART 6 – LINE STRIPING AND EVENT MARKINGS

6.01 Layout



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
04 JANUARY 2024

Line striping and event markings shall be laid out as indicated on drawings.

6.02 Certification

Upon completion of the installation, the owner shall be supplied with all necessary computations and drawings as well as a letter of certification attesting to the accuracy of the markings.

PART 7 - GUARANTEE

The Synthetic Track Surfacing System shall be fully guaranteed against faulty workmanship and material failure for a period of five (5) years from the date of acceptance. Synthetic surfacing material found to be defective as a result of faulty workmanship and/or material failure shall be replaced or repaired at no charge, upon written notification within the guarantee period.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 32 80 00 - IRRIGATION

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work:

1. Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the installation of an automatic sprinkler irrigation system, including all piping, sprinkler heads, controls, connections, testing, etc. as shown on the Drawings and as specified herein. The water source for this project is potable water.
2. Utilize and accept as standards manufacturer's recommendations and/or installation details for any information not specifically detailed on the Drawings.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions, for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.
- B. Section 01 8113, Sustainable Design Requirements, for CAL-Green [and Collaborative for High Performance Schools (CHPS)] general requirements and procedures.
- C. Section 03 1000, Concrete Forming.
- D. Section 32 1600, Site Concrete.
- E. Division 26, Electrical
- F. Section 31 0000, Earthwork.
- G. Section 31 2333, Trenching and Backfilling.
- H. Section 32 9000, Landscaping.

1.03 REFERENCES AND STANDARDS

- A. California Building Code (CBC), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).
- B. California Green Building Standards Code (CALGreen), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

MTW Group  
3186070000

IRRIGATION  
32 80 00- 1

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.04 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements

B. Pre-Installation Meeting:

1. Request and hold a pre-installation meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and the Landscape Architect.

1.05 ACTION SUBMITTALS

- A. Product names are used as standards; provide proof as to equality of any proposed material and do not use other materials or methods unless approved in writing by the Owner's Representative. Submit no more than one request for substitution for each item. The decision of the Owner's Representative is final.
- B. Use equipment capacities specified herein as the minimum acceptable standards.
- C. List materials in the order in which they appear in Specifications; include substitutions. Submit the list for approval by the Owner's Representative.
- D. Make any mechanical, electrical, or other changes required for installation of any approved, substituted equipment to satisfaction of Owner's Representative and without additional cost to Owner. Approval by Owner's Representative of substituted equipment and/or dimensional drawing does not waive these requirements.
- E. Do not construe approval of material as authorization for any deviations from Specifications unless attention of Owner's Representative has been directed to specified deviations.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data for the following:
  1. For landscape contractor.
- B. Certification: Installer for central control system.
- C. Sample of manufacturers' warranty.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- D. Record of Pre-Installation Meeting.
- E. Sustainable Design:
  - 1. General:
    - a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
    - b. Sustainable design submittals are in addition to other submittals.
  - 2. The following information shall be provided:
    - a. Adhesives and Sealants: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.
    - b. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

1.07 CLOSEOUT SUBMITTALS

- A. Warranty/Guarantee: Submit executed warranty and subcontractor's guarantee.
- B. Maintenance and Operating Instructions:
  - 1. Furnish operating maintenance instructions bound in a hardback binder and indexed. Start compiling data upon approval of list of materials. Do not request final inspection until booklets are approved by Owner's Representative.
  - 2. Incorporate the following information in these sets:
    - a. Complete operating instructions for each item of irrigation equipment.
    - b. Typewritten maintenance instructions for each item of irrigation equipment.
    - c. Manufacturer's bulletins which explain installation, service, replacement parts, and maintenance.
    - d. Service telephone numbers and/or addresses posted in an appropriate place as designated by Owner's Representative.
- C. Record Drawings

1.08 QUALITY ASSURANCE

- A. Qualifications: Work must be complete by a licensed Landscape Contractor. Provide proof of five years' continuous experience in landscaping and irrigation of projects of similar size.
- B. Certification: Ensure that the contractor installing the Central Control System is trained and certified in the installation of the Central Control System. The training and certification must have been completed within two years prior to the installation date.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- D. Reviews: Specifically request reviews of all items listed in Article INSPECTION REQUIREMENTS, prior to progressing to the next level of work.
- E. Standards:
  - 1. Provide work and material in full accordance with the rules and regulations of the National Electric Code; the Uniform Plumbing Code; and other applicable state or local laws or regulations.
  - 2. Furnish, without extra charge, additional material and labor required to comply with these rules and regulations, though the work may not be specifically indicated in the Specifications or Drawings.
  - 3. Where the Specification requirements exceed those of the above-mentioned codes and regulations, comply with the requirements in the Specifications.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict conformance with the manufacturer's written recommendations.
- B. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles, with tags and labels intact. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.
- C. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, blocked off ground.
- D. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect related work and material.
- E. Handle plastic pipe carefully, especially protecting it from prolonged exposure to sunlight. Store pipe on beds that are the full length of the pipe, and keep pipe flat.

1.10 FIELD CONDITIONS

- A. Information on Drawings relative to existing conditions is approximate. During progress of construction, make deviations necessary to conform to actual conditions, as approved by Owner's Representative, without additional cost to Owner. Accept responsibility for any damage caused to existing services. Promptly notify Owner's Representative if services are found which are not shown on Drawings.
- B. Protect existing trees-to-remain as specified in "Existing Tree Protection" in Article PREPARATION, in Part 3 of this Section.

MTW Group  
3186070000

IRRIGATION  
32 80 00- 4

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- C. Protect existing utilities within construction area. Repair damages to utility lines that occur as a result of operations of this work.
- D. Verify dimensions at building site and check existing conditions before beginning work. Make changes necessary to install work in harmony with other crafts after receiving approval by Owner's Representative.

1.11 INSPECTION REQUIREMENTS

- A. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
  - 1. Pressure testing of all mainlines and lateral lines (See "Hydrostatic Tests – Open Trench" in Article FIELD QUALITY CONTROL, in Part 3 of this Section),
  - 2. Trench depth,
  - 3. Sleeves under pavement,
  - 4. Flushing of all mainlines and lateral lines,
  - 5. Backfill and pipe bedding,
  - 6. Layout of heads,
  - 7. Operation of system and coverage adjustments (with Landscape Architect) after system is fully automated and operational, backfill of trenching is completed, and surface has been restored to original grades.
- B. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

1.12 WARRANTY AND GUARANTEE

- A. Manufacturer: In addition to the Contractor's and Subcontractor's Guarantee, furnish Owner with manufacturer's available fully executed written warranty against defects in materials and workmanship.
- B. Subcontractor Guarantee: Shall include damage by leaks and settlement of irrigation trenches.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design:

1. VOC emissions for field-applied adhesives, sealants, and sealant primers must comply with limits specified in Section 01 6116.
2. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.03 MATERIALS

A. Central Control System: As indicated on Drawings.

B. Master Valves and Flow Sensors: As indicated on Drawings.

C. Automatic Control Valves: As indicated on Drawings.

D. Gate Valve: As indicated on Drawings.

E. Pipe and Fittings:

1. PVC pipe: As indicated on Drawings.
2. PVC fittings for mainline two inches (2") and smaller and all lateral lines: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.
3. Ductile iron fittings for all mainline fittings two and one-half inches (2 ½") and larger: Leemco joint restraint fittings or approved equal.
4. All plastic pipe and fittings: Continuously and permanently marked with manufacturer's name, type of material, IPS size, schedule, NSF approval, and code number.
5. Threaded PVC pipe and nipples: IPS Schedule 80 when necessary to use threaded connections to gauges, valves, or control valves. Threaded adapters may be used in place of nipples when making pipe to valve connections.
6. Use 45-degree fittings for changes in depth of pipe, and at transition from main line to automatic control valves.
7. Piping above ground: Schedule 40 galvanized steel with cast-iron fittings.

F. Booster Pump: As indicated on Drawings.

G. PVC Primer: Weld-On P-70 Purple Primer or approved equal.

H. PVC Glue: Weld-On 711 Gray heavy bodied PVC Cement or approved equal.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- I. PVC Glue for connections to Flexible PVC: Weld-On 795 Blue Flex PVC Cement or approved equal.
- J. Sprinkler Heads: As indicated on Drawings.
- K. Quick Coupler Valves: As indicated on Drawings.
- L. Sleeves: As indicated on Drawings.
- M. All Valve Boxes and Covers: Manufactured, green with "Irrigation – Non-Potable" permanently embossed on cover. Carson, Rainbird or approved equal.
- N. Reduced Pressure Backflow Preventer: As indicated on Drawings.
- O. Automatic Sprinkler Control Wire:
  - 1. Connections between remote control valves and controller: UF-14 direct burial polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Common wire to be white, and lead wire to be colored. If multiple controllers are used, a different color is to be used for each controller's lead wire. (Use red for the first controller). Spare wires are to be yellow.
  - 2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
  - 3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.
  - 4. Electrical, other than low voltage, such as power wiring, conduit, fuses, thermal overloads and disconnect switches, is included under Division 26 of these Specifications.
- P. Trace Wire:
  - 1. Direct burial #12 AWG Solid, steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30-volt rating. Color shall be green.
  - 2. Connectors: UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
- Q. Master Valve and Flow Sensor Connection to Controller:
  - 1. Master valve wires are to be UF-14 direct burial plastic-coated wire. Wire color to be blue for the lead and white for the common.
  - 2. Flow sensor wires are to be UF-14 direct burial plastic-coated wire.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

R. Unions And Flanges:

1. Steel unions and flanges two inches (2") and smaller: 150 lb. screwed black (brass to iron seat) or galvanized malleable iron (ground joint).
2. Steel unions and flanges two and one-half inches (2 ½") and larger: 150 lb. black flange union, flat-faced, full gasket.
3. Gaskets: One-sixteenth inch (1/16") thick rubber Garlock No. 122, Johns-Manville or approved equal.
4. Flange Bolts: Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper-plated steel bolts and nuts or brass bolts and nuts for brass flanges.

S. Sand for Trench Backfill: Natural sand, free of roots, bark, sticks, rags, or other extraneous material

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to commencement of the work of this Section, obtain written verification from the project Civil Engineer that the rough grade in landscape areas is in conformance with Section 31 0000 - Earthwork.
- B. Examine conditions of work in place before beginning work; report defects.

3.02 PREPARATION

- A. Scheduling: Notify the Project Inspector prior to commencing and/or continuing the work of this Section. Remove and replace, at no cost to Owner, any work required as a result of failure to give the appropriate notification.
- B. Measurements: Take field measurements; report variance between plan and field dimensions.
- C. Protection: Maintain warning signs, shoring and barricades as required. Prevent injury to, or defacement of, existing improvements. At no additional cost to Owner, repair or replace items damaged by installation operations.
- D. Existing Tree Protection:
  1. Avoid unnecessary root disturbance, compaction of soils within drip line, or limb breakage.
  2. Do not store material or dispose of any material other than clean water within the drip line.
  3. Provide adequate irrigation during construction.

MTW Group  
3186070000

IRRIGATION  
32 80 00- 8

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

4. Replace any tree damaged during construction with a tree of equal size and value at no additional cost to Owner.
  5. Adjust trench locations in field to minimize damage to existing elements and plant roots of trees-to-remain at no additional cost to Owner.
- E. Surface Preparation: Prior to beginning sprinkler irrigation work, complete placement of topsoil as specified in Section 31 0000 – Earthwork. Notify Project Inspector of irregularities if any.

3.03 AUTOMATIC CONTROLLER/CENTRAL CONTROL SYSTEM

- A. Central Control System and controls: Install system and components as per Drawings and manufacturer's recommendations. All wiring connections shall be neatly accomplished within the controller cabinet. Connect Ethernet and grounding system as per manufacturer's recommendations.
- B. Connect automatic control valves to controller(s) in sequence as shown on Drawings.
- C. Install all exposed wires to a minimum of twenty-four inches (24") beyond controller within a UL approved rigid conduit.
- D. Required Start-up Procedures:
1. Install controllers, master valves, flow sensors, ground system, wiring, cables, Ethernet and any other components not shown on the Drawings.
  2. Request that the manufacturer's representative participate and/or direct the start-up of the Central Control System. Start-up shall include all testing and settings for the following:
    - a. Flow sensor
    - b. Grounding
    - c. Wire connections
    - d. Pump start
    - e. Bypass
    - f. Overall instruction
  3. Upon successful completion of testing by the technician from V-Power, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
  4. Run the system; record the flows per valve and report them to the Owner's Representative.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.04 MASTER VALVES AND FLOW SENSOR

- A. Master Valve: Install as per manufacturer's recommendation. Connect master valve wiring to the automatic controller. Install wire in a conduit. Wire is not to have any splices between the valve and the controller.
- B. Flow Sensor: Install as per manufacturer's recommendation. Connect flow sensor wire to the automatic controller. Install wire in a conduit. The wire is not to have any splices between the valve and the controller.

3.05 REDUCED-PRESSURE BACKFLOW-PREVENTION DEVICE

- A. Install where shown, per code, and per manufacturer's specification and written instructions.
- B. Provide pipe supports and accessories as necessary to properly secure the assembly.

3.06 BOOSTER PUMP ASSEMBLY

- A. Booster Pump: Install as per manufacturer's directions and as detailed on Drawings. Lay out piping in field for exact locations and/or connections.
- B. Booster Pump Pad: Install on a level, raised utility pad so booster pump is set level. Encase anchor bolts in the concrete pad.
- C. Piping Assembly: Lay out system plumb and level. Paint entire assembly, including the pipe supports. Use metal pipe for all exposed pipe and extend below the ground to the horizontal main line pipe.
- D. Coordination: Lay out conduit for electrical components to minimize conduit above grade.
- E. Required Start-up Procedures:
  - 1. Order booster pump as soon as possible to avoid delays in the project.
  - 2. After booster pump and electrical connections have been installed, power has been made available, the downstream irrigation system has been pressure-tested, heads have been set, and trenches have been backfilled and compacted, request that the booster pump manufacturer's technician participate in and/or direct the start-up of the booster pump. Start-up shall include all testing and settings for the following:
    - a. Flow
    - b. Pressure
    - c. Connections
    - d. Electrical currents
    - e. Wire connections
    - f. Pump installation

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Upon successful completion of testing by the booster pump technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.

3.07 GRADING

- A. Install all irrigation features to their finished grade and at depths indicated. Complete and /or accommodate all rough grading and/or finish grading before commencing with trenching.

3.08 LAYOUT

- A. Lay out work as accurately as possible to Drawings. Drawings are generally diagrammatic to extent that swing joint offsets and fittings are not shown. Record all changes on the Record Drawings.
- B. Do not willfully install the irrigation system as shown on Drawings when it is obvious, in the field, that obstructions or other discrepancies exist which may not have been considered in the design. Notify Owner's Representative of discrepancies before proceeding.

3.09 EXCAVATING AND TRENCHING

- A. General: Perform excavations as required for installation of work included under this Section, including shoring of earth banks to prevent cave-ins. Restore surfaces, existing underground installations, etc., damaged or cut as result of this work to their original condition and in a manner approved by the Landscape Architect.
- B. Width:
  1. Make trenches wide enough to allow a minimum of six inches (6") between parallel pipelines and three inches (3") between side of pipe and side of trench. Do not allow stacking of pipe within trench.
  2. Allow a minimum clearance of twelve inches (12") in any direction from parallel pipes of other trades.
- C. Preparation of Excavations: Remove rubbish and rocks from trenches. Bed pipe on a minimum of three inches (3") of clean, rock-free soil to provide a firm, uniform bearing for entire length of pipeline. If clean, rock-free soil is not available, use sand for pipe bedding. See Backfill and Compacting for the remainder of the trench backfill.
- D. Minimum depth of cover: Unless shown otherwise, provide the following minimums:
  1. Mainline: twenty-four inches (24") cover.
  2. Lateral line: twelve inches (12") cover for spray heads, and eighteen inches (18") cover for rotor heads.

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IRRIGATION  
32 80 00- 11

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- E. Conflicts with other trades:
1. Hand-excavate trenches where potential conflict with other underground utilities exist.
  2. Where other utilities interfere with irrigation trenching and piping work, adjust the trench depth as instructed by Owner's Representative.

3.10 BACKFILL AND COMPACTING

- A. General: Do not begin until hydrostatic tests are completed and when system is operating and after required tests and inspections have been made.
- B. Backfill directly around the pipe: Cover pipe with a minimum of three inches (3") of clean, rock-free soil. If clean, rock-free soil is not available, use sand for three inches (3") of backfill above the pipe. The remainder of the trench backfill material can be native soil or material described below. Do not allow wedging or blocking of pipe.
- C. For backfill of trenches under paving areas:
1. See Section 31 0000 – Earthwork for compaction rates and material
  2. See Section 31 2333 – Trenching and Backfilling for trench backfill procedure.
- D. For backfill of trenches in landscape areas:
1. Place backfill in six-inch (6") layers and compact with an acceptable mechanical compactor.
  2. Compact backfill material in landscape areas to eighty-five percent (85%) maximum dry density of the soil.
  3. If settlement occurs along trenches, make adjustments in pipes, valves, and sprinkler heads, soil, sod or paving as necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, without additional cost to the Owner.
- E. Excess Soil: Remove all rocks, debris, and excess soil that results from sprinkler irrigation trenching operations, landscape planting, and soil preparation operations off site at no additional cost to the Owner. If soil meets topsoil requirements in Section 31 0000 – Earthwork, it may be used for finish grading.
- F. Finishing: Dress-off areas to eliminate construction scars.

3.11 CONTROL WIRES

- A. General: Install control wires beneath sprinkler main line whenever possible; tape wires to mainline pipe. Provide one spare wire for each controller.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Slack Wire: Provide eighteen inches (18") of slack wire for each wire connected to automatic control valve. Slack wire shall be coiled and left in the valve box. Tape wires in bundles every ten feet (10'); do not tape wires in sleeves.
- C. Expansion and Contraction: Snake wire in trench to allow for contraction of wire.
- D. Wire Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12") beyond edges of paving or construction.
- E. Wire Connections: Install wire connections in a waterproof sealing pack.
- F. Wire Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.
- G. Wire Termination: Install wire in a valve box with eighteen inches (18") of slack wire coiled and individually capped with approved waterproof sealing pack.
- H. Spare Wire: Install two (2) spare wires along each wire path. If there is more than one wire path from the controller, the contractor to install two (2) spare wires per path. Provide eighteen inches (18") of slack wire at each automatic control valve.

### 3.12 FLUSHING LINES

- A. Thoroughly flush lines prior to installing valves, performing hydrostatic testing, or installing sprinklers. Divert water to prevent washouts.

### 3.13 AUTOMATIC CONTROL AND QUICK COUPLER VALVES

- A. Install where shown and where practical; place no closer than twelve inches (12") to walk edges, building walls, or fences. Refer to detail for example.
- B. Thoroughly flush mainline before installing valve.
- C. Install valves in ground cover areas where possible.

### 3.14 PIPING

- A. General: Install in conformance with reference standards, manufacturer's written directions, as shown on Drawings and as herein specified.
- B. Workmanship:
  - 1. General: Install sprinkler irrigation equipment in planted areas throughout the site.
  - 2. Coordination: Organize location of sleeves with other trades as required.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Pipe Line Assembly:

1. General:

- a. Cutting: Cut pipe square; remove rough edges or burrs.
- b. Solvent-welded Connections: Use materials and methods recommended by the pipe manufacturer.
- c. Brushes: Use non-synthetic brushes to apply solvents and primer.
- d. Cleaning: Clean pipe and fittings of dirt, moisture, and debris prior to applying solvent or primer.
- e. Assembly: Allow pipe to be assembled and welded on the surface or in the trench.
- f. Expansion and Contraction: Snake pipe from side to side of trench to allow for expansion and contraction.
- g. Location: Locate pipes as shown on Drawings except where existing supply valves, utilities or obstructions prohibit or where slight changes are approved to better suit field conditions.

2. Flexible Elastometric Seal Joints:

- a. General: Assemble in strict conformance with the pipe manufacturer's instruction.
- b. Rubber Rings: Use rubber rings specific for water service systems.
- c. Cleaning: Thoroughly clean ring and groove of dirt, moisture and debris using a clean, dry cloth. Do not use solvents, lubricants, cleaning fluids or other material for cleaning.
- d. Seating: Properly seat ring in groove.
- e. Spigot:
  - 1) General: Clean spigot-end of pipe as in "Cleaning" above prior to applying lubricant recommended by pipe manufacturer.
  - 2) Seating: Insert spigot into bell and seat to full depth required.

3. Connections:

- a. Threaded Plastic Pipe Connection:
  - 1) Use Teflon tape or pipe joint compound.
  - 2) When assembling to threaded pipe, take up joint no more than one full turn beyond hand-tight.
- b. Metal Valves and Plastic Pipe: Use threaded plastic male adapters.
- c. Metal to Metal Connections:
  - 1) Use specific joint compound or gasket material for type of joint made. Where pipe of dissimilar metals are connected, use dielectric fittings.
  - 2) Where assembling, do not allow more than three full threads to show when joint is made up.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- d. Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use a metal-jawed wrench.
  - e. Threading:
    - 1) Do not permit the use of field-threading of plastic pipe or fittings. Use only factory-formed threads.
    - 2) Use factory-made nipples wherever possible. Permit the use of field-cut threads in metallic pipe only where absolutely necessary. When field-threading, cut threads accurately on axis with sharp dies.
    - 3) Use pipe joint compound for all threaded joints. Apply compound to male thread only.
  - 4. Sleeves and conduits:
    - a. Use sleeves of adequate size to accommodate retrieval for repair of wiring or piping and extend a minimum of twelve inches (12") beyond edges of walls or paving.
    - b. Provide removable, non-decaying plug at end of sleeve to prevent entrance of soil.
  - 5. Unions: Locate unions for easy removal of equipment or valve.
  - 6. Joint Restraints: Install per manufacturer's recommendations.
  - 7. Capping: Plug or seal opening as lines are installed to prevent entrance materials that would obstruct pipe. Leave in place until removal is necessary for completion of installation.
- D. Drip Irrigation Tubing: Install as per Drawings.

### 3.15 SPRINKLER HEADS

- A. Sprinkler heads: Locate as shown on the Drawings except where existing conditions prohibit, or slight changes are approved to achieve as good or better coverage under the same conditions. Do not allow sprinkler head spacing to exceed the maximum shown on the Drawings. Plumb heads.
- B. Handling, Assembly of Pipe, Fittings, and Accessories: Allow only skilled tradesmen to handle and assemble pipe, fittings and equipment. Keep interior of pipes, fittings and accessories clean at all times. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation. Do not permit bending of pipe.
- C. Flushing: Remove end heads and operate system at full pressure until all rust, scale, and sand is removed. Divert water to prevent ponding or damage to finished work.
- D. Coverage: Accept responsibility for full and complete coverage of irrigated areas to satisfaction of Landscape Architect and make necessary adjustments to better suit field conditions at no additional costs to Owner.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.16 CONCRETE WORK

- A. Underground anchors and pads for valves boxes are included under this Section of Specifications. Concrete shall have a minimum strength of 2500 psi. The slump test shall be a four inch (4") maximum slump. At twenty-eight days, the concrete shall have a minimum strength of 2500 psi. Use materials and mix in accordance with ASTM C 94. Refer to Section 32 1600 – Site Concrete.

3.17 FIELD QUALITY CONTROL

- A. Visual Inspection: Verify that all pipe is homogenous throughout and free from visual cracks, holes, or foreign materials. Inspect each length of pipe. All materials are subject to impact test at the discretion of the Landscape Architect.
- B. Hydrostatic Tests – Open Trench:
  - 1. Center-load piping with a small amount of backfill to prevent arching or slipping under pressure.
  - 2. Request the presence of the Project Inspector in writing at least forty-eight hours in advance of testing.
  - 3. At no additional cost to Owner, test in the presence of the Project Inspector.
  - 4. Apply continuous static water pressure of 100 psi when welded plastic joints have cured at least twenty-four hours, and with the risers capped, as follows: test main lines and submains for four hours; test lateral lines for two hours.
  - 5. Repair leaks resulting from tests; and repeat tests.
  - 6. Test to determine that all sprinkler heads function according to manufacturer's data and give full coverage according to intent of Drawings. Replace any sprinklers not functioning as specified with ones that do, or otherwise correct system to provide satisfactory performance.
- C. Continuity Testing: Test locating device and control wires for continuity prior to and after back-filling operations.

3.18 CLEAN-UP

- A. Remove debris resulting from work of this Section.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.19 ADJUSTMENTS AND MAINTENANCE

- A. Adjusting System: Prior to acceptance, satisfactorily adjust and regulate entire system. Set watering schedule on controller appropriate to types of plants and season of year. Adjust remote control valves to operate sprinkler heads at optimum performance based on pressure and simultaneous demands through supply lines.
- B. System Layout: Provide reduced prints of Record Document irrigation plans, laminated in four (4) mil. plastic, of size to fit controller door. Enlarge remote-control valve designations as necessary for legibility. Color-code areas covered by each station. Affix plans to inside of controller door.
- C. Instructions: Upon completion of work, instruct maintenance personnel on operation and maintenance procedures for entire system.
- D. Flow Charts: Record and prepare an accurate flow-rate chart for each automatic control valve.

3.20 RECORD DRAWINGS

- A. As specified in Section 01 3300, Submittal Procedures, and the following:
  - 1. Regularly update plans of the system and any changes made to the system throughout the project. Record all changes on this plan before trenches are back-filled.
  - 2. Record complete as-built information and submit the Record Drawings to the Architect before applying for payment for work installed.
  - 3. Show the following on the Record Drawings accurately to scale and dimensioned from two permanent points of reference:
    - a. and spares Distance of mainline from nearby hardscape.
    - b. Location of automatic control valves, quick couplers, and gate valves.
    - c. Location and size of all sleeves.
    - d. Location of automatic control wires.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

SECTION 32 90 00 - LANDSCAPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Soil Preparation and Fertilization
2. Planting
3. Sodding
4. Weed Control
5. Decomposed Granite
6. Mulch
7. Clean-up
8. Landscape Maintenance Period

- B. Work not included in this Section: Landscape elements such as concrete walks, fencing, outdoor lighting, rough grading, and clearing are not a part of this Section unless shown on the landscape Drawings.

1.02 RELATED REQUIREMENTS

- A. Section 01 8113, Sustainable Design Requirements, for CAL-Green [and Collaborative for High Performance Schools (CHPS)] general requirements and procedures.
- B. Section 31 0000, Earthwork.
- C. Section 32 8000, Irrigation

1.03 REFERENCES AND STANDARDS

- A. California Building Code (CBC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).
- B. California Green Building Standards Code (CALGreen), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).
- C. EPA - Federal Insecticide, Fungicide and Rodenticide Act.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.04 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

B. Pre-Installation Meeting: Request and hold a pre-installation meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and Landscape Architect.

C. Pre-scheduled On-site Project Meetings: Hold regularly-scheduled (monthly or bimonthly as determined by the Landscape Architect) on-site project meetings with the Landscape Architect, Project Inspector and Owner's Representative. Dates and times will be jointly agreed upon.

1.05 ACTION SUBMITTALS

A. Plant Material: Within fifteen (15) days after award of contract, locate plant materials required for construction. Ensure that trees and shrubs are contract-grown from a certified nursery. Notify Owner's Representative of plant material "tied off" for review at selected nursery. If specified material is not obtainable, submit the following to Owner's Representative: proof of non-availability, proposal for use of equivalent material, photographs of alternative choices of plant material. Include clear, written description of type, size, condition, and general character of plant material.

B. Data Sheets:

1. Provide product data for each type of landscape material indicated in the Drawings and Specifications.
2. Letter from the manufacturer stating that the soil amendment material submitted for use on this project has no metal fragments or foreign objects.

C. Samples: Submit samples of the following materials to Landscape Architect for approval:

1. Soil amendment: (3) one-quart zip-locked plastic bags.
2. Bark Mulch: (3) one-quart zip-locked plastic bags.
3. Imported Topsoil: (3) one-quart zip-locked plastic bags.
4. Decomposed Granite: (3) one-quart zip-locked plastic bags.

D. Provide soils analysis reports prepared by a qualified soils laboratory in accordance with the Soils Testing Requirements under "Soil Testing" in Article SOIL TESTING, in Part 3 of this section.

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LANDSCAPING  
32 90 00- 2

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape contractor.
- B. Prior to planting, submit copies of all trucking or packaging tags for all soil amendment, fertilizer and other additives to Landscape Architect so the quantities can be verified.
- C. Record of Pre-Installation Meeting.

1.07 CLOSEOUT SUBMITTALS

- A. Guarantee: Submit Subcontractor's guarantee.
- B. Record Drawings.

1.08 QUALITY ASSURANCE

- A. Qualifications: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+/- 20% of the construction cost) and scope for education campuses. Landscape Contractor to have a minimum of two projects either completed or in construction in the last five years.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- C. Reviews: Specifically request reviews of all items listed below in Article INSPECTION REQUIREMENTS prior to progressing to the next level of work. The Owner's Representative reserves the right to inspect and reject material, both at place of growth and at site, before and/or after planting, for compliance with requirements for name, variety, size and quality.
- D. Reference Standards: Meet or exceed Federal, State and County laws requiring inspection of all plants and planting materials for plant disease and insect control.
- E. Plant Material:
  - 1. Conform to the current edition of Horticultural Standards for quality of Number 1 grade nursery stock as adopted by the American Association of Nurserymen. Conform to sizes specified on plant legend. Select plants which have a natural shape and appearance.
  - 2. Select only plants that are true to name, and tag one of each bundle or lot with the name of the plant in accordance with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3. Tag each plant of a patented variety with the variety and identification number, where applicable, as it is delivered to the job site.
4. Select only plants which have been nursery-grown in accordance with good horticultural practices and which have been grown under climatic conditions similar to those in the locality of the project for at least one year.
5. Select only plants which are typical of their species or variety; have normal habits of growth; are sound, healthy, vigorous, well-branched and densely-foliated when in leaf; are free of disease, insect pests, eggs or larvae; and have a healthy and well-developed root system.
6. Select only container stock that has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Provide samples to show that there are no root-bound conditions.
7. Do not use plants that are severely pruned or headed-back to meet size requirements.
8. Do not plant container-grown plants that have cracked or broken balls of earth when taken from the container. Remove canned stock carefully from cans after containers have been cut on two sides with tin snips or other approved cutter.
9. At any time prior to final acceptance, be prepared to replace any plants that are rejected by the Owner's Representative because of physical damage to the plant.
10. Do not remove container-grown stock from containers before time of planting.
11. Be prepared to replace plants which are rejected by the Owner's Representative for the following reasons:
  - a. Trunk bark damage caused by sunburn,
  - b. Trunk bark wounds caused by rubbing stakes or ties,
  - c. Trunk bark damage caused by ties that have girdled the tree,
  - d. Tree head development that is lopsided and not symmetrical in form,
  - e. Tree branches that cross or touch,
  - f. Tree branches with double leaders (unless multi-trunk trees are specified).
12. Stake shrubs with one-inch by one-inch by eighteen-inch (1"x1"x18") stakes in such manner that the stakes are not visible, and tie to upright position if they lean and/or are not growing in a vertical position.
13. Furnish quantities necessary to complete the work as shown on the Drawings and, if necessary, make up for any discrepancies in the quantities given in the Plant List at no additional cost to Owner.

F. Mock-up: Decomposed Granite with Binder.

1. Install 4 ft wide x 10 ft long mock-up of decomposed granite with Stabilizer additive at location as directed by owner's representative for review and acceptance prior to placement of decomposed granite.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

1.09 DELIVERY, STORAGE AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Coordinate a time for the Landscape Architect to inspect the plants upon their delivery to the project site.
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways or pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

1.10 FIELD CONDITIONS

- A. Planting Season Limits: Do not plant when grounds are wet or temperature is below 25° F. Do not proceed with any soil preparation and fertilization if all planting cannot be completed within Planting Season Limit.

1.11 INSPECTION REQUIREMENTS

- A. Landscape Architect reserves the right to examine and reject plant material both at place of growth and at site, before and after planting, for compliance with requirements of name, variety, size, and quality.
- B. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
  - 1. Rough grading is to tolerances specified in Section 31 0000 – Earthwork.
  - 2. The placement of landscape backfill material is as specified in this Section.
  - 3. Prior to the commencement of planting operations specified in this Section, the coverage and operation of the sprinkler irrigation system are as specified in Section 32 8000 - IRRIGATION.
  - 4. Required Test: For each load of soil amendment delivered to the site, spread at least two cubic yards (2 cy) of material onto a paved surface approximately two inches (2”) deep. Pass a magnetic rake over the material in two directions. If any metal is found, test the entire load in the same manner. Perform all testing in the presence of the Project Inspector.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Soil amendments, fertilizer, bark mulch and materials used for hydroseeding have been delivered to the site by the supplier, the invoices from the supplier indicate the project name and quantities delivered, and the Project Inspector has received copies of all such documents.
6. Prior to planting, amendments and conditioners have been incorporated as per pre-planting recommendations, and planting areas have been made ready to receive planting.

- C. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

#### 1.12 PROTECTION

- A. Provide protection for persons and property throughout progress of work. Use temporary barricades as required. Proceed with work in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel. Store materials and equipment where directed.
- B. Existing Construction: Execute work in an orderly and careful manner to protect paving, work of other trades, and other improvements.
- C. Existing Utilities: Provide protection for existing utilities within construction area. At no additional cost to Owner, repair any damages to utility lines that occur as a result of this work.
- D. Landscaping: Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods.

#### 1.13 PLANTING SCHEDULE

- A. Install, establish, and maintain all lawn areas for a minimum of ninety (90) days prior to date of substantial completion. Coordinate schedule with other work and overall project schedule. Failure to install lawn areas by this date shall result in assessment of liquidated damages.
- B. Proceed with work in an orderly and timely manner to complete installation of landscaping within contract limits.

#### 1.14 LANDSCAPE MAINTENANCE PERIOD REQUIREMENTS

- A. Beginning of Landscape Maintenance Period:
  1. General: Landscape Maintenance Period does not begin until all work is installed and either the sod has been placed or hydroseeded lawn has evenly germinated



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

to an approximated blade height of one and one-half inches (1 ½”), as determined by Landscape Architect, in writing.

2. On-site Inspection: When all work is complete, request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner’s Representative who must together authorize and determine the start date for the landscape maintenance period. Coordinate and give notice of the date and time of the on-site meeting to all parties at least forty-eight (48) hours in advance.
3. Acceptability: In cases where the lawn has reached adequate fullness and germination in some areas but not all, and authorization has not been given to begin the maintenance period, proceed with mowing, trimming, spraying, etc., as necessary prior to the beginning of the maintenance period.

B. Duration of Landscape Maintenance Period:

1. The Landscape Maintenance Period shall continue for a minimum of ninety (90) calendar days. During this time, continuously maintain all areas involved until final acceptance of the work by the Owner’s Representative. See Landscape Maintenance Period procedure in Article LANDSCAPE MAINTENANCE, in Part 3 of this Section.

1.15 GUARANTEE

- A. The guarantee period for lawn and plant material shall be the duration of the landscape maintenance period, from commencement until final acceptance of the work of this Section.
- B. During the guarantee period, repair and/or replace plants and lawn not in satisfactory growing condition, as determined by Owner’s Representative, without additional cost to Owner. Plants are to be replaced in accordance with Article LANDSCAPE MAINTENANCE in Part 3 of this Section, using plants of the same kind and size specified in plant list.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Use material in new and perfect condition as specified. Any deviations or substitutions from the Specification and Drawings must first be approved by Owner’s Representative in writing prior to use.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.02 SOIL PREPARATION MATERIALS

- A. Topsoil: Fertile; friable; natural loam surface soil; reasonably free of subsoil, clay lumps, brush, weeds and other litter; and free of roots, stumps, stones/rocks, and other extraneous or toxic matter harmful to plant growth.
- B. Soil Amendment: One-percent nitrogen-impregnated bark product with a ninety-percent (90%) bark base and zero to one-quarter inch (0-1/4") particle size, or approved equivalent. Do not spread until testing requirements have been satisfied.
- C. Fertilizer/Soil Conditioner: Gro-Power Plus or approved equal.
- D. Fertilizer for Trees and Shrubs: Seven-gram Gro-Power Planting Tablets (12-8-8 NPK) or approved equal.
- E. Vitamin B-1: "Superthrive", "Liquinox Start", "Cal-Liquid", or approved equal.

2.03 MISCELLANEOUS LANDSCAPE MATERIALS

- A. Bark Mulch: Untreated, shredded cedar.
- B. Tree-staking System: As indicated on Drawings.
- C. Pre-Emergent Weed Control: Oxadiazon, "Treeflan", "Ronstar 2G", "Surflan" (Elano Products Company), or approved equal.
- D. Decomposed Granite:
  - 1. Reddish-brown in color.
  - 2. A mixture of fines to three-eighths inch (3/8") size particles with no clods.
  - 3. Free of vegetation, other soils, debris and rocks, and of such nature that it can be compacted readily under watering and rolling.
- E. Decomposed Granite Binder: Shall be Stabilizer by Stabilizer Solutions.
- F. Weed Fabric: As indicated on Drawings.
- G. Header Boards: As indicated on Drawings.
- H. Landscape Concrete Mowstrips: See Section 32 1600 Site Concrete for material and mix.
- I. Root Barrier: As indicated on Drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

2.04 PLANT MATERIAL

A. Nursery Plant Stock:

1. As indicated on Drawings. Do not remove container-grown stock from containers until planting time. Plants shall be true to name.
2. Healthy, shapely, well-rooted, not pot-bound, free from insect pests or plant diseases and properly "hardened off" before planting. Replace plants that are not alive or are not in satisfactory growing condition, as determined by the Landscape Architect, without additional cost to Owner. The Landscape Architect may reject plants before and/or after planting.
3. Labeled. Label at least one tree and one shrub of each species with a securely-attached, waterproof tag bearing legible designation of botanical and common name.

B. Lawn Sod: Eighty percent (80%) Perennial Ryegrass and twenty percent (20%) Kentucky Bluegrass.

PART 3 - EXECUTION

3.01 SITE CONDITIONS

- A. Examine the site, verify grade elevations, and observe conditions under which work is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Representative.
- B. Proceed with complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.
- C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand-excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- D. When conditions detrimental to sod or plant growth are encountered, such as rubble fill, adverse drainage condition, or other obstructions, notify the Owner's Representative before planting.

3.02 SOIL TESTING

- A. Coordinate soil testing in an expeditious and timely manner as required for on-site topsoil materials. Contract with a soil laboratory and include cost of sampling and testing in contract price. Take one (1) sample for every 5,000 square feet of landscape area up to a maximum of six (6) samples under the direction of and in the presence of the Owner's Representative.

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MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- B. Submit each sample, according to the quantity of soil required by testing laboratory, to a competent laboratory approved by the Owner's Representative.
- C. Provide analysis of soil samples for pH, salinity, ammonia, phosphate, potassium, calcium, magnesium, boron, and sodium levels. Provide appraisal of chemical properties, including particle size determination, and recommendations for types and quantities of amendments and fertilizers.

### 3.03 PREPARATION

#### A. Clearing of Vegetation:

1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days.
2. Clear and remove existing weeds by mowing or grubbing off all plant parts at least one-quarter inch ( $\frac{1}{4}$ " ) inch below surface of soil over entire areas to be planted.

#### B. Soil preparation:

1. Loosen soil in all planting areas, and on slopes flatter than 3:1 gradient, to a depth of six to eight inches (6" - 8") below finish grade. All debris, foreign matter, and stones shall be removed prior to the placing of any fertilizers or conditioners. Soil preparation is for all shrub planting beds, lawn hydroseeded areas and sodded lawn areas.
2. Conduct the required soil tests and instruct the lab to include a minimum of the following soil improvements in the recommendation on the soils report.
  - a. Soil Amendment: Two cubic yards (2 cy) per 1,000 square feet.
  - b. Gro-Power Plus: One hundred fifty pounds (150 lbs) per 1,000 square feet.
  - c. If the lab recommends less than six cubic yards (6 cy) of soil amendment, the excess bid amount shall be applied to the cost of any additional recommended soil improvements, or returned to the Owner as a credit.
3. Apply amendments as follows, using rates recommended by the soils testing laboratory (the rates of amendments shown below are for bidding purposes only):
  - a. Fertilizer/Soil Conditioner: Broadcast 150 pounds of Gro Power Plus per 1,000 square feet in all planting areas and rototill to a depth of six to eight inches (6" - 8"). Remove from the site any rock and debris brought to the surface by cultivations. "Cultipack" all areas to receive sod or hydroseed.
  - b. Apply soil amendment to all planting areas at the rate of six cubic yards (6 cy) per 1,000 sf and rototill into the top six to eight inches (6" - 8").
4. Upon completion of finish grading, request an review and obtain approval of Landscape Architect prior to commencement of planting or hydroseeding.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Finish Grading for all Planting areas

1. Refer to Earthwork Specification Section for Rough Grading.
2. Grade to elevations and contours shown on Drawings. Fill low spots with landscape backfill material and grade to surface drain in manner indicated on Drawings.
3. Finish-grade so that the entire area within the contract lines has a natural and pleasing appearance as specified and as directed by Landscape Architect.
4. Adjust sprinkler heads flush to finish grade in preparation to receive hydroseeding or one-half inch above finish grade in preparation to receive sod. Reset sprinkler heads flush to grade after turf has germinated.
5. Flag the sprinkler heads and valve markers.

D. Planting Pits for Trees:

1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Set container-grown stock in center of pit on earth pedestal. Separate roots and/or prune roots as directed by Landscape Architect. In hot weather, pre-wet pit. Loosen outside roots from sides and bottom of root ball. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Water after placing final layer of backfill.
3. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
4. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

E. Planting Pits for Shrubs/Groundcover:

1. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
3. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.04 ROOT BARRIER INSTALLATION

- A. Install root barrier where trees are planted within sixty inches (60") of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise shown on Drawings.
- B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of five feet (5') in each direction from the tree trunk, for a total distance of ten feet (10') per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  - 1. Position top of root barrier one inch (1") below finish grade.
  - 2. Do not distort or bend root barrier during construction activities.
  - 3. Do not install root barrier surrounding the root ball of tree.

3.05 PLANTING

- A. Lawn Sod:
  - 1. Cultivate all lawn areas to a depth of six inches (6"). If cultivation does not break lumps, pull a spike-toothed harrow over the area behind the tractor.
  - 2. Give all lawn areas that are to be sodded a smooth finish to prevent pockets. Do not allow any abrupt changes of surface. Prior to installation of sod, roll the grade with a 200-pound water-ballast roller. Request that the lawn grade be inspected and approved by the Landscape Architect prior to sodding to determine its suitability for planting. Obtain such approval prior to commencing sodding operations.
  - 3. Do not take heavy objects (except lawn rollers) over lawn areas after they have been prepared for planting.
  - 4. Completely lay the sod within twelve hours (12 hrs) of delivery. Do not leave sod on pallets in the hot sun longer than necessary.
  - 5. Unroll sod carefully. Lay sod tight without any visible open joints, and without overlapping; stagger end joints twelve inches (12") minimum. Do not stretch or overlap sod pieces. Do not place sod in pieces smaller than twenty-four inches (24") in length by width of roll.
  - 6. When new sod is to match existing turf, cut the edge of the existing turf in a series of straight lines that will accept new sod rolls in full width of the sod roll. Make the transition of grade between existing turf and new sod to be seamless with no change in elevation.
  - 7. Immediately after laying sod, roll lawn areas with a 200-pound water-ballast roller.
  - 8. Trim sod to conform to lawn shapes designated in Drawings.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

9. On slopes of six inches (6") per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at a maximum of two feet (2') on center. Drive pegs flush with soil portion of sod.
10. Ensure that finished appearance is that of one continuous lawn.
11. Do not lay whole lawn before watering. When a conveniently large area has been sodded, water lightly to prevent drying. Continue to lay sod and to water until installation is complete.
12. All sod areas must be approved by Landscape Architect.
13. Water the complete lawn surface thoroughly. Moisten soil at least eight inches (8") deep. Repeat sprinkling at regular intervals to keep sod moist at all times until rooted. After sod is established, decrease frequency and increase amount of water per application as necessary.

B. Trees, Shrubs, and Groundcover:

1. Lay out individual tree and shrub locations and areas for multiple plantings. Stake the locations, outline the areas, and secure the Owner's Representative's acceptance before beginning the planting work. Make minor adjustments as requested.
2. Scarify root ball prior to planting. Plant in holes twice the diameter of the root ball and to a depth equal to the container's height. Place the shrub and/or groundcover so the top of the root ball is one inch (1") higher than the surrounding grade; place the tree so that the crown of the trunk is two inches (2") higher than the surrounding grade. Set container-grown stock in center of pit. In hot weather, pre-wet the pit. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Thoroughly compact lower half of backfill in plant pit. See staking or guying detail. Water after planting. Provide a berm or watering basin for each tree. Add Vitamin B-1, in the proper solution as recommended by the manufacturer, to the second watering of the basin.
3. Place fertilizer planting tablets in root zone and alongside each plant. Follow manufacturer's instructions for number of tablets to use for each container size.
4. See Drawings for additional information.
5. Grooming and Staking of Trees:
  - a. Prune, thin-out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Landscape Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees.
  - b. Paint cuts over one-half inch ( $\frac{1}{2}$ ") in size with standard tree paint or compound, covering exposed, living tissue. Use paint that is waterproof, antiseptic, adhesive, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- c. Stake or guy trees immediately after planting, as indicated on Drawings.
- 6. Grooming of Shrubs:
  - a. Prune, thin-out and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and to accomplish their use in landscape design. The required plant size is its size after pruning.
  - b. Remove and replace excessively pruned or malformed new plants resulting from improper pruning.
- C. Request review by the Landscape Architect after locating, but prior to planting all trees. Under the direction of the Landscape Architect, make slight adjustments to plant material location as necessary to reflect original intention of Drawings.

### 3.06 WEED CONTROL

- A. Apply pre-emergent weed control to all planting areas (except lawn) after completion of all planting and one complete watering. Follow manufacturer's directions. To prevent washing away of weed control, do not over-water after its application. Do not allow any weed control into lawn areas. Treat any existing noxious weeds, such as Johnson grass, with Roundup in successive treatments until all roots are destroyed, then remove all grass and roots. Notify Owner's Representative of time of installation for verification of application.

### 3.07 BARK MULCH

- A. Apply mulch at the rate of three inches (3") deep to all planting areas, exclusive of lawn, after the planting and weed control are completed. Twelve inches (12") from planter edges, taper full depth of mulch to meet adjacent grades. Do not place mulch within three inches (3") of trunk or stems.

### 3.08 DECOMPOSED GRANITE WITH BINDER

- A. General: Prepare all areas to receive decomposed granite, and treat sub-grade with weed control.
- B. Placement:
  - 1. After pre-blending, place the Stabilized decomposed granite on prepared sub-grade. Level to desired grade and cross section.
  - 2. Water heavily for full-depth moisture penetration of the Stabilized pathway profile, 25 to 45 gallons of water per 1-ton must be applied. During water application randomly test for depth using a probing device, which reaches full depth.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

C. Compaction:

1. Upon thorough moisture penetration, compact aggregate screening to 85% relative compaction by equipment such as; a 2 to 4-ton double drum roller or a 1,000-lb. single drum roller. The roller size will depend on the depth of the pathway. DO NOT use a vibratory plate compactor or vibration function on roller as vibration separates large aggregate particles. Do not begin compaction for 6 hours after placement and up to 48 hours.
2. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.
3. Take care in compacting decomposed granite when adjacent to planting and irrigation systems. Hand tamping with a 8" or 10" hand tamp recommended.

D. Inspection:

1. Finished surface of pathway shall be smooth, uniform and solid. There shall be no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material will not be present on the surface after installation, but may appear after use and according to environmental conditions. Pathway should remain stable underneath the loose granite on top. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

E. Repairs:

1. Excavate damaged area to the depth of the stabilized decomposed granite and square off sidewalls.
2. If area is dry, moisten damaged portion lightly.
3. Pre-blend the dry required amount of Stabilizer powder with the proper amount of decomposed granite in a concrete mixer.
4. Add water the pre-blended decomposed granite and stabilizer. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
5. Apply moistened pre-blended decomposed granite to excavated area to finish grade.
6. Compact with an 8"-10" hand tamp or 250 to 300-pound roller. Keep traffic off area for 12 to 48 hours after repair has been completed.

- F. Upon end of landscape maintenance period, all weed/grass shall have been removed and surface re-compacted.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

3.09 CLEAN-UP

- A. During construction, keep the site free of rubbish and debris, and clean up the site promptly when notified to do so. Take care to prevent spillage on streets from hauling and immediately clean up any such spillage and/or debris deposited on streets due to the work of this Section.
- B. During all phases of the construction work, take all precautions to abate dust nuisance by clean-up, sweeping, sprinkling with water, or other means as necessary.
- C. Paving: Maintain cleanliness of paving areas and other public areas used by equipment, and immediately remove spillage; remove rubbish, debris, and other material resulting from landscaping work, leaving site in a safe and clean condition.

3.10 LANDSCAPE MAINTENANCE

- A. The Landscape Maintenance Period will begin when all the Landscape Maintenance Period Requirements have been met (See Part 1 of these Specifications).
- B. Cleaning: Maintain cleanliness on paving areas and other public areas used by equipment and immediately remove all spillage. Remove from project site all rubbish and debris found thereon and all material and debris resulting from landscaping work, leaving the site in a safe and clean condition.
- C. Maintenance:
  - 1. Sprinkler Irrigation System:
    - a. Check system weekly for proper operation. Flush lateral lines out after removing last sprinkler head or two at each end of lateral. Adjust all heads as necessary for unimpeded coverage.
    - b. Set and program automatic controllers for seasonal water requirements. Provide the Owner's Representative with keys to the controllers and instructions on how to turn off system in case of emergency.
    - c. Repair all damages to sprinkler irrigation system as part of the contract work. Make repairs within one watering period or one week, whichever is the least amount of time.
  - 2. Turf Areas:
    - a. Begin mowing turf when grass has reached a height of three inches (3") and cut to a height of one-half inches to two inches (1 ½" - 2"). Mow at least weekly after the first cut. Turf must be well-established and free of bare spots and weeds, to satisfaction of Landscape Architect, prior to final acceptance. Do not mow lawns when the soil is not able to support maintenance equipment. Repair wheel marks and ruts caused by the maintenance equipment at no additional cost to the Owner.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

- b. Pick up grass clippings and remove from the site and premises.
  - c. Trim edges at least twice monthly for neat appearance. Vacuum or blow clippings off walks.
  - d. Water the lawns at such frequency as weather conditions require to replenish soil moisture below the root zone. Normally, a total of one and one-half inches (1 ½") of water is needed weekly in hot weather.
  - e. Fertilize the lawn areas at the beginning of the Landscape Maintenance Period and at the completion of the Landscape Maintenance Period. Use a fertilizer with the following characteristics:
    - 1) Slow release, Best 16-6-8, or approved equal, at the rate of 6.25 lbs per 1,000 square feet from March through October.
    - 2) Calcium Nitrate (15-0-0) at the rate of 6.5 lbs per 1,000 square feet from November through February.
  - f. Broadcast fertilizer using a mechanical spreader; do not apply by hand-broadcasting. Sweep all fertilizer off hardscape into adjacent planters.
  - g. Weekly as needed and as directed, re-sod lawn areas with material that matches previously installed material. Use sod to repair any bare areas. Repair areas to receive sod as follows:
    - 1) Mark out areas to receive new sod repair.
    - 2) Cut straight lines that will accept sod the full width of the roll and a minimum of twenty-four inches (24") in length.
    - 3) Transition the grade between existing turf and new sod seamlessly, with no change in elevation.
3. Trees and Shrubs:
- a. Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
  - b. Construct and/or remove water basins around each plant, depending on the time of the year and as directed.
  - c. Do not prune unless directed by the Landscape Architect.
  - d. Re-stake and re-tie trees as needed and as directed by the Landscape Architect. Do not allow tops of tree stakes to protrude into head of tree.
  - e. Replace any dead, dying or vandalized plant material on a weekly basis throughout the Landscape Maintenance Period.
4. Insecticide and Herbicide Application:
- a. If needed, control weeds with selective herbicides and sprays. In areas where crabgrass has infested the lawn, apply pre-emergent herbicides such as Dacthal by Amvac, Balan, or Betasan by Gowan for control prior to crabgrass germination. Control insect pests if necessary.
  - b. Use only a licensed Pest Control Operator to apply herbicides and sprays and to maintain a log for applications indicating material, timing, and rate.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
SACRAMENTO, CALIFORNIA  
100% CONSTRUCTION DOCUMENTS  
4 JANUARY 2024

5. Decomposed Granite with Binder:
  - a. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.
  - b. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16" to 1/4"). If this material exceeds a 1/4", redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1,000 lbs. This process should be repeated as needed.
  - c. If cracking occurs, sweep fines into the crack, water thoroughly and hand tamp with an 8"-10" hand tamp plate.
  
- D. Final Acceptance of the Landscape Maintenance Period: request on-site meeting forty-eight hours (48 hrs.) in advance with the Landscape Architect and Owner's Representative to determine the end of the Landscape Maintenance Period.

END OF SECTION

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

SECTION 33 40 00 - SITE DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Storm Drain piping, fittings, structures.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 16 00, Site Concrete.
5. Section 33 00 00, Earthwork.

6. Section 31 31 00, Soil Treatment

1.02 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. NFPA 13, 24 and 25, latest editions as adopted by CFC Chapter 80 referenced standards.
- J. California State Health and Safety Code Section 116875, Lead Free Public Water

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

Systems.

- K. California Plumbing Code, latest edition.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.
- D. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.
  - 1. Sun damaged or discolored PVC pipe will be rejected.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.
- E. Per 2022 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.05 FEES, PERMITS, AND UTILITY SERVICES

- A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.08 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.09 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
- H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.10 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.11 RECORD DRAWINGS

- A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.
- B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.
- C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.
- D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6" dia. 12" deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe: Use one of the following, unless noted on the Drawings otherwise.
  - 1. Polyvinyl Chloride Pipe (PVC): SDR35 conforming to ASTM D3034 with elastomeric joints conforming to ASTM D3212. Sun damaged pipe will be rejected.
  - 2. High density polyethylene pipe (HDPE): The pipe shall be corrugated exterior/smooth interior pipe and water tight per ASTM D3212 with dual wall water tight gasket fittings.



MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

- B. Perforated Pipe (for subdrains): Shall be ADS N12 pipe, 3 hole, ASTM F 405, AASHTO M 252; PVC ASTM D3034 SDR-35 storm drain pipe
- C. Drop Inlet: Shall be as shown on the drawing details.
- D. Mortar: For pipe connections to concrete drainage structures, conform to ASTM C270 type N mortar. Place within one half hour after adding water.
- E. Crushed Rock: Imported washed crushed rock. Minimum 100% passing 3/4 inch sieve.
- F. Clean-outs: Shall be as shown on the drawing details.
- G. Filter Fabric: Mirafi 140N.

### PART 3 - EXECUTION

#### 3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

#### 3.02 INSTALLATION

- A. General: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. Excavation and Bedding:
  - 1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width in accordance with pipe manufacturer's recommendations and as per the drawings. Follow manufacturer's recommendations for use of each kind and type of pipe.
  - 2. Bedding: Provide bedding as detailed on plans for the full length of the pipe.

MATSUYAMA ELEMENTARY SCHOOL MODERNIZATION  
7680 WINDBRIDGE DRIVE, SACRAMENTO, CA 95831  
20 DECEMBER 2023

Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, whichever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.

3. If the trenches for the site drainage fall within areas to be lime treated, the piping shall be installed prior to any lime treatment operations.
  - a. If additional piping is added to previously lime treated areas, the contractor shall backfill the trench with class 2 aggregate base and compact to 95%.

D. Laying of Pipe:

1. General: Inspect pipe prior to placing. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe upgrade, true to line and grade.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution or as recommended by manufacture. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.
3. Pipe shall be bedded uniformly throughout its length.
4. Pipe elevation shall be within 0.02 feet of design elevation as shown on plans.
5. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the governing agency.

E. Backfilling:

1. General: Do not start backfill operations until required testing has been accomplished.
2. Trenches and Excavations: Backfill with material as detailed on plans, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Refer to Section 31 23 33 – TRENCHING AND BACKFILLING for fill above this layer.

F. Grouting of Pipes: Grout pipes smooth and water tight at drop inlet, manholes, and curb inlets. Grout back side of hood at curb inlets all grouting shall be smooth and consistent.

G. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the local agency.

H. Cutting and Patching: Remove and replace existing surface features per applicable specification section (i.e. asphaltic concrete or concrete paving) where pipe is installed in areas of existing improvements.

3.03 TOLERANCES

A. Storm Drain structure grates

1. In landscape and lawn areas +/- 0.05'.
2. In sidewalk and asphalt pavement +/- 0.025'.
3. In curb and gutter application +/- 0.0125'.

B. Cleanout Boxes and Lids

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20 DECEMBER 2023

1. In landscape areas; 0.10 higher than surrounding finish grade,  $\pm 0.05'$ .
2. In sidewalks and asphalt pavement; Flush with surrounding finish grade,  $\pm 0.025'$ .

3.03 DEWATERING

- A. Contractor to provide trench dewatering as necessary, no matter what the source is, at no additional cost to the owner.
- B. If the previously excavated material from trenching is too wet to achieve trench backfill compaction the contractor shall make a reasonable effort to aerate and dry the material per section 31 00 00, 3.08, B

3.04 FLUSHING

- A. The Contractor shall thoroughly ball and flush the storm drain system to remove all dirt and debris. Discharge water to an approved location.

3.05 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean the dirt, rocks, and debris from all storm drain inlets, structures, and connecting pipes.

END OF SECTION