

DANA ELEMENTARY SCHOOL
NEW CLASSROOM BUILDINGS

PROJECT MANUAL

LMUSD PROJECT # 0606

LUCIA MAR UNIFIED SCHOOL DISTRICT
NIPOMO, CALIFORNIA

FEBRUARY 13, 2026



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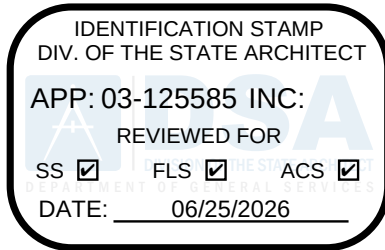


380 Pacific Street
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SPECIFICATIONS
Finney Project No. 24149

DSA File No. 40-39
DSA Application No. 03-125585
OPSC: 68759-135

**NEW CLASSROOM BUILDINGS
AT DANA ELEMENTARY SCHOOL**

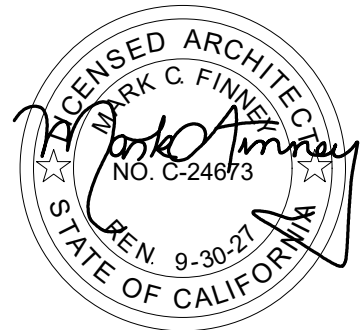


LUCIA MAR UNIFIED SCHOOL DISTRICT
San Luis Obispo County, California

Division of the State Architect
Department of General Services



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TABLE OF CONTENTS – TECHNICAL SPECIFICATIONS

DIVISION 0 - PROCUREMENT AND CONTRACTING REQUIREMENTS

(SEE FRONT ENDS)

DIVISION 1 - GENERAL REQUIREMENTS

(SEE FRONT ENDS)

DIVISION 02 – EXISTING CONDITIONS

02 30 00 – SUBSURFACE INVESTIGATIONS
02 41 13 – SELECTIVE SITE DEMOLITION

DIVISION 05 – METALS

05 51 33 – STEEL ACCESS LADDERS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

06 20 00 – FINISH CARPENTRY

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 13 26 – SELF ADHERING SHEET WATERPROOFING
07 21 00 – THERMAL INSULATION
07 25 00 – WEATHER-RESISTIVE BARRIERS
07 26 15 – CONCRETE MOISTURE VAPOR CONTROL
07 26 16 – BELOW SLAB VAPOR BARRIER
07 31 13 – ASPHALT SHINGLES
07 60 00 – SHEET METAL FLASHING AND TRIM
07 92 00 – JOINT SEALANTS

DIVISION 08 - OPENINGS

08 11 13 – HOLLOW METAL DOORS AND FRAMES
08 14 16 – FLUSH WOOD DOORS
08 31 00 – ACCESS DOORS AND PANELS
08 51 13 – ALUMINUM WINDOWS
08 71 00 – DOOR HARDWARE
08 80 00 – GLASS AND GLAZING
08 91 00 – LOUVERS AND VENTS

DIVISION 09 – FINISHES

09 21 16 – GYPSUM BOARD ASSEMBLIES
09 24 00 – PORTLAND CEMENT PLASTER

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

09 30 13 – CERAMIC TILING
09 51 13 – ACOUSTICAL PANEL CEILINGS
09 65 13 – RESILIENT WALL BASE AND ACCESSORIES
09 65 16 – RESILIENT SHEET FLOORING
09 68 13 – TILE CARPETING
09 72 16 – VINYL COATED PRE-WRAPPED WALL PANELS
09 77 50 – FIBERGLASS REINFORCED WALL PANELS (FRP)
09 91 00 – PAINTING

DIVISION 10 - SPECIALTIES

10 11 00 – VISUAL DISPLAY SURFACES
10 14 00 – SIGNAGE
10 21 13 – TOILET COMPARTMENTS
10 28 00 – TOILET ACCESSORIES
10 44 00 – FIRE PROTECTION SPECIALTIES

DIVISION 12 - FURNISHINGS

12 35 13 – PLASTIC LAMINATE CASEWORK

DIVISION 22 – PLUMBING

22 00 00 – PLUMBING GENERAL REQUIREMENTS
22 05 00 – PLUMBING

DIVISION 23 HEATING VENTILATION AND AIR CONDITIONING

23 00 00 – MECHANICAL GENERAL REQUIREMENTS
23 05 00 – HEATING VENTILATING AIR CONDITIONING
23 05 93 – TESTING ADJUSTING BALANCING

DIVISION 26 – ELECTRICAL

26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL
26 05 01 – SELECTIVE ELECTRICAL DEMOLITION
26 05 19 – LOW VOLTAGE WIRE AND CABLE
26 05 26 – GROUNDING AND BONDING
26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 53 – IDENTIFICATION OF ELECTRICAL SYSTEMS
26 09 23 – OCCUPANCY SENSORS
26 09 43 – NETWORK LIGHTING CONTROLS
26 24 16 – PANELBOARDS
26 27 26 – WIRING DEVICES
26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 31 00 – SOLAR PV SYSTEMS
26 51 00 – INTERIOR LIGHTING
26 56 00 – EXTERIOR LIGHTING
26 56 70 – LIGHTING ACCEPTANCE TESTING
26 77 00 – ASSISTIVE LISTENING SYSTEM

DIVISION 27 – COMMUNICATIONS

27 13 00 – INTERCOMMUNICATIONS SYSTEM

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

28 31 00 – FIRE ALARM & DETECTION SYSTEMS

DIVISION 31 – EARTHWORK

31 10 00 - SITE CLEARING
31 20 00 - EARTH MOVING
31 20 10 – GRADING

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 00 10 - FIELD ENGINEERING
32 12 14 - SUBGRADE AND ROADBED
32 12 15 - AGGREGATE BASE
32 12 16 - ASPHALT CONCRETE PAVING
32 13 13 – SITE CONCRETE PAVING
32 17 00 – PAVEMENT SPECIALTIES
32 31 20 – ORNAMENTAL STEEL FENCING
32 92 00 – TURF PLANTING

DIVISION 33 – UTILITIES

33 00 10 - TRENCHING, BACKFILLING, AND COMPACTING
33 10 00 - WATER UTILITIES
33 30 00 - SANITARY SEWER UTILITIES
33 40 00 - STORM DRAINAGE UTILITIES

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 023000 - SUBSURFACE INVESTIGATIONS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Section includes: This section describes the subsurface conditions observed during the Geotechnical Investigation for this project. The Geotechnical Report is available for review upon written request from the Architect for the cost of printing.

B. Related Work:

1. Section 312000 - Earthwork
2. Geotechnical Investigation Report as described in Section 312000 - Earth Moving

1.2 OBSERVED SUBSURFACE CONDITIONS

A. Subsurface Conditions:

1. See the Geotechnical Investigation Report as described in Section 312000 - Earth Moving.

B. Actual Conditions:

1. The subsurface information provided is based on soil borings and observations made during the Geotechnical Investigation and are not a guarantee of actual subsurface conditions. If any variations or undesirable conditions are encountered during construction, the contractor shall notify the Geotechnical Engineer and the Architect so that supplementary direction can be given.
2. Existing utilities and facilities shown are based on record drawings and surface observations. The contractor shall verify locations of existing utilities to protect, identify for relocation, or remove, as necessary for the performance of work to complete this project.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 02 41 13 - SELECTIVE SITE DEMOLITION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Demolition, removal, salvage and disposal of existing site features, fences, structures and materials where indicated on the drawings and as specified in this section.
- B. Demolition and removal of concrete foundations, sidewalks, concrete and asphaltic paving as shown on the drawings
- C. Demolition and removal of existing utilities as shown on the drawings

1.02 RELATED SECTIONS

- A. Section 01 50 00 – Temporary Facilities and Controls
- B. Section 02 41 16 – Building Demolition
- C. Section 31 10 00 – Site Clearing

1.03 SUBMITTALS

- A. Permits and Certificates.
 - 1. Permits and notices authorizing building demolition.
 - 2. Certificates of severance of utility service.
 - 3. Permit for transport and disposal of debris.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division One specifications.
- B. Accurately record actual locations of capped utilities and subsurface obstructions.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable State and local codes for demolition of structures, safety of adjacent structures, dust control, and disposal.
- B. Obtain required permits from authorities.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct roadways, sidewalks, or hydrants without written permission from Owner.
- E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials and notify owner immediately.
- F. Notify Owner a minimum of 48 hrs. in advance of interrupting or shutting down any utilities.

1.06 SCHEDULING

- A. Schedule and submit under provisions of Division One specifications.
- B. Provide detailed descriptions for demolition and removal procedures.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

- A. Fill Material: Use on site fill material under provisions of Section 31 20 00 – Earthwork

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify areas to be demolished are unoccupied and discontinued in use.
- B. Do not commence work until conditions are acceptable to Engineer.

3.02 PREPARATION

- A. Provide, erect, and maintain temporary barriers, enclosures, security fences and shoring at demolition locations in accordance with Division One and other related specifications to protect personnel.
- B. Protect existing structures and utilities which are not to be demolished.
- C. Provide temporary wiring and connections to maintain existing telephone, electrical, instrumentation and control systems in service during construction.
- D. Protect designated trees and plants from damage.
- E. Mark location of existing utilities.

3.03 GENERAL REQUIREMENTS

- A. Sprinkle Work with water to minimize dust where applicable. Provide hoses and water connections for this purpose.
- B. Do not use water to extent causing flooding, contaminated runoff, or icing.
- C. Break concrete into sections less than 2 feet in any dimension, and remove from site
- D. Repair damage to adjacent structures.
- E. Remove existing exposed piping and electrical wiring and conduit to be abandoned to structural surface, cut flush, and finish to match existing surfaces.
- F. Remove buried piping, wiring, and conduit to be abandoned as required for the Work. Plug the remainder flush.

3.04 DISPOSAL

- A. Do not store or burn waste materials on-site.
- B. Transport demolition debris to designated off-site disposal area.

3.05 SITE DEMOLITION

- A. Disconnect, remove, cap and identify designated utilities within demolition area.
- B. Remove asphalt paving, parkway, curb, gutter, sidewalk and other concrete as shown on plans. Remove concrete to nearest joint beyond demolition area.
- C. Remove and dispose of existing site fencing as shown on the plans
- D. Remove storm sewer items where shown on the drawings.
- E. Backfill areas excavated caused as a result of demolition, in accordance with Section 31 20 00 - Earthwork.
- F. Rough grade and compact areas affected by demolition to maintain site grades and contours as shown on drawings.
- G. Remove demolished materials from site.

- H. Do not burn or bury materials on site, unless otherwise directed by Owner. Leave site in clean condition.
- I. Pavement striping to be removed shall be painted over with "black-out" paint, or mechanically removed, as long as it is not deeper than 1/8", so as to not introduce visible depressions, rough areas, or markings in pavement.

3.06 ELECTRICAL DEMOLITION

- A. General:
 - 1. Remove, relocate and extend existing installation to accommodate new construction.
- B. Existing Electrical Service:
 - 1. Work by Contractor:
 - a) Provide standby power conduit and cables for temporary use during construction. Completely remove temporary service after new permanent service is installed.

3.07 BUILDING DEMOLITION

- A. Remove and dispose of all remaining portions of main building and storage buildings.
- B. Refer to architectural plans for detailed building demolition information.

END OF SECTION

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New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 05 51 33 – STEEL ACCESS LADDERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fixed steel access ladders.

1.3 REFERENCES

- A. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

- A. Submit under provisions of the general conditions.
- B. Product Data: Manufacturer's data sheets on each product.
- C. Shop Drawings:
 - 1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. Provide reaction loads for each hanger and bracket.
- D. Qualification Data:
 - 1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.
- E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.
- F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
 - 1. Record of successful in-service performance.
 - 2. Sufficient production capacity to produce required units.
 - 3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

- B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.
- C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Install ladder in area designated by Architect.
 - 2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
 - 3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurement before fabrication.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

- A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
 - 1. Defects in materials and workmanship.
 - 2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
 - 3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.
- B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

- A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Cotterman – Bakersfield Plan. 6901 Distrit Blvd, Bakersfield, CA 93313. Toll Free Tel: (888) 653-3333. Tel: (661) 617-6033. Email: info@cotterman.com. Web: <http://www.cotterman.com>.
- B. Substitutions: Or approved equal.
- C. Requests for substitutions will be considered in accordance with provisions of the general conditions.

2.2 APPLICATIONS/SCOPE

- A. Fixed and Cage Ladder Design:
 - 1. Safety cages are required on ladders over 24 feet (7315 mm)
 - 2. Safety cages are required on all ladders in high or hazardous areas.
 - 3. Landing platforms are required at 50 feet (15,240 mm) above the bottom of the ladder.
 - 4. Rail and harness fall arrest system as alternate to safety cage and landing platforms shall be a permissible manufacturer's option.
 - a. Fixed Ladder Bottom Bracket:
 - b. Bottom floor supported bracket.
 - c. Bottom wall supported bracket.
 - d. Bracket as drawn.
- B. Fixed Access Ladder:
 - 1. Series F Fixed Ladders
 - a. Exact model and number of rungs to be determined based on as-built conditions.
 - b. Outside width: 20 inches.
 - c. Fully wall mounted, above floor.

2.3 FINISHES

- A. Powder coated finish.
 - 1. Color: to be selected by architect from manufacturer's available standard colors.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. First paragraph below specifies minimum yield point of 30 ksi (205 MPa); revise if higher strength is required.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

2.5 FABRICATION

- A. Ladder shall be one-piece welded assembly.
- B. Rungs: 3/4" steel round deformed bars on 12" centers, welded all around to side rails.
 - 1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.
- C. Channel Side Rails: 1/4" x 2" x 2" steel angle, continuous.
- D. Stand off wall mounting brackets shall be 60" o.c., 7" from wall, fabricated from 1/4" steel bar. Fully welded to side rails and with holes for bolting to wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
- B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
- C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

- A. Install in accordance with project drawings, manufacturer's instructions, and in proper relationship with adjacent construction.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Exterior standing and running trim.
2. Exterior plywood soffits.
3. Interior standing and running trim.
4. Interior plywood and board paneling.

- B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Division 8 Section "Door Hardware" for Builders Hardware.
3. Division 8 Section "Wood Doors".
4. Division 9 Section "Painting" for priming and back-priming of finish carpentry.

1.3 DEFINITIONS

- A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWI – American Woodwork Institute
4. NHLA - National Hardwood Lumber Association.
5. RIS - Redwood Inspection Service.
6. WCLIB - West Coast Lumber Inspection Bureau.
7. WI - Woodwork Institute "Manual of Millwork".
8. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

C. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

B. Fire-Test-Response Characteristics: Where fire-retardant materials are indicated, provide materials with specified fire-test-response characteristics as determined by Underwriters Laboratory, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.

C. Treated Wood Materials: Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials. For each type specified, include certification by treating plant stating chemical solutions used, submersion period and conformance with specified standards.

D. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

E. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in the meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Plywood Siding:
 - a. Champion International Corp.
 - b. Georgia-Pacific Corp.
 - c. Louisiana-Pacific Corporation.
 - d. Pacific Wood Laminates, Inc.
 - e. Simpson Timber Co.
 - 2. Hardwood Veneer Plywood Paneling:
 - a. Champion International Corp.
 - b. Georgia-Pacific Corp.
 - c. Weyerhaeuser Company.

2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

- B. Softwood Plywood: DOC PS 1/ANSI A199.1.
- C. Hardwood Plywood: HPVA HP-1.
- D. Hardboard: AHA A135.4
- E. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
- F. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS (Trt-Wd)

- A. Water-Repellent Preservative Treatment by Non-pressure Process: AWP A N1.
 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chlorpyrifos.
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 3. Application: Exterior trim and wood siding.

2.4 FIRE-RETARDANT-TREATED MATERIALS (F Trt-Wd)

- A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:
 1. Flame-spread index of not greater than 25 when tested according to ASTM E 84.
- B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- C. Exterior-Type Fire-Retardant Treatment: Organic-resin-based formulation that shows no increase in flame spread of treated material after being weathered according to ASTM D 2898, Method A.
- D. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.
- E. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

- F. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

2.5 EXTERIOR STANDING AND RUNNING TRIM

- A. Lumber Trim for Semitransparent-Stained or Clear-Finished Applications: Kiln-dried lumber with saw-textured face and of the following species and grade:
 - 1. Clear All Heart redwood where indicated; RIS.
 - 2. Grade B & B Btr. - 1 & 2 Western red cedar where indicated; WCLIB, or WWPA.
- B. Lumber Trim for Painted Applications: Kiln-dried, finger-jointed or solid lumber with surfaced smooth face and of the following species and grade:
 - 1. Clear redwood; RIS.
 - 2. Grade B & B Btr. - 1 & 2 Western red cedar; WCLIB, or WWPA.
- C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.
 - 1. Moldings for Semitransparent Finish (Stained Finish): N-grade redwood, western red cedar, or sugar pine as indicated.
 - 2. Moldings for Opaque Finish (Painted): P-grade redwood, western red cedar, or sugar pine.
 - 3. Patterns as indicated.
- D. MDO Trim: Exterior Grade B-B, MDO plywood.

2.6 INTERIOR STANDING AND RUNNING TRIM

- A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Kiln-dried finished lumber (S4S) of the following species and grades:
 - 1. Grade - Clear All Heart Redwood where indicated; Para 103 RIS.
 - 2. Clear Maple where indicated; WCLIB, or WWPA.
 - 3. Manufactured to sizes and patterns (profiles) shown.
- B. Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:
 - 1. Grade D Select (Quality) Idaho white, lodgepole, ponderosa, or sugar pine; WWPA.
 - 2. Grade D Select white woods; WWPA.
 - 3. Grade A Finish alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA.
- C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded under WMMPA WM 4.
 - 1. Moldings for Transparent Finish (Stain or Clear Finish): N-grade Idaho white, lodgepole, ponderosa, or sugar pine, western red cedar, douglas fir, or yellow poplar].

- a. Provide material selected for compatible grain and color.
2. Moldings for Opaque Finish (Painted): P-grade Idaho white, lodgepole, ponderosa, or sugar pine, or yellow poplar.
3. Manufactured to sizes and patterns (profiles) shown.

2.7 PANELING

- A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with applicable requirements in HPVA HP-1.
1. Face Veneer Species: Plain-sliced red oak.
 2. Backing Veneer Species: Any hardwood compatible with face species.
 3. Construction: Veneer core.
 4. Thickness: 7/16 inch.
 5. Panel Size: As indicated on the drawings.
 6. Glue Bond: Type II (interior).
 7. Face Pattern: As selected by Architect from manufacturer's standard patterns.
 8. Finish: As selected by Architect from manufacturer's full range.

2.8 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches into substrate, unless otherwise recommended by manufacturer:
1. Hot-dip galvanized steel.
 2. Pre-finished aluminum in color to match stain, where face fastening of material to receive stain is unavoidable.
- B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
- C. Paneling Adhesives: Comply with paneling manufacturer's written recommendations for adhesives.
- D. Flashing: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" for flashing materials installed in finish carpentry.
1. Horizontal Joint Flashing for Siding: Preformed galvanized steel Z-shaped flashing.
- E. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.9 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
- B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
 - 1. Exterior standing and running trim wider than 5 inches.
 - 2. Interior standing and running trim, except shoe and crown molds.
 - 3. Wood board paneling.
- C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Pre-installation Meeting: Meet at project site prior to delivery of finish carpentry materials and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Architect and other Owner Representatives (if any), Installers of finish carpentry, wet work including plastering, other finishes, painting, mechanical work and electrical work, and firms and persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with finish carpentry on interior only when everyone concerned agrees that required ambient conditions can be properly maintained.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.
- C. Painted Lumber: Prime lumber for exterior applications to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.

- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
 - 1. Match color and grain pattern across joints.
 - 2. Install trim after gypsum board joint finishing operations are completed.
 - 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
 - 4. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.5 PANELING INSTALLATION

- A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
 - 1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
 - 2. Conceal fasteners to greatest practical extent.
 - 3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

3.6 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

- A. Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that the work will be without damage or deterioration at time of acceptance.

END OF SECTION 06 20 00

(3/06)

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rubberized-asphalt sheet waterproofing.
 - 2. Asphalt polyethylene sheet waterproofing at openings.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

- F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing. (See Special Project Warrantee requirements below)

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer, with a minimum of 3 years of experience installing like projects, who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate and until opening and penetration work has been completed.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Project Warrantee: Provide written warranty, signed by Contractor, Installer and Manufacturer of primary waterproofing materials, agreeing to replace/repair defective

materials and workmanship, including significant leakage of water, abnormal aging or deterioration of materials, and other failures of sheet waterproofing to perform as required within warranty period. During warranty period, repairs and replacements required because of acts of God and other events beyond Contractor's/ Installer's/Manufacturer's control (and which exceed performance requirements) shall be completed by Contractor/Installer and paid for by Owner at prevailing rates.

1. Warranty period is 10 years after date of substantial completion. (*Project Close-out Item*)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following products:

1. Rubberized-Asphalt Sheet Waterproofing:
 - a. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW Mira DRI 860.
 - b. W. R. Grace & Co.; Bituthene.
 - c. W. R. Meadows, Inc.; Mel-Rol.
 - d. Pecora Corporation; Duramem 700-SM.
 - e. Tamko Roofing Products, Inc.; TW-60.
 - f. Or preapproved equal.
2. Asphalt Polyethylene Sheet Waterproofing, at openings:
 - a. W. R. Grace & Co.; Vycor V40.
 - b. Or preapproved equal.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
1. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

- B. Rubberized-Asphalt Sheet, at openings: 40-mil- thick, self-adhering sheet consisting of rubberized-asphalt membrane with cross-laminated polyethylene, with the following physical properties measured per standard test methods referenced:
 - 1. Pliability: No cracks when bent 180 degrees over a 1-inch mandrel at minus 25 deg F; ASTM D 146.
 - 2. Hydrostatic-Head Resistance: 150 feet minimum.
 - 3. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 - 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
 - 2. Detail Strips: 62.5-mil- thick, felt-reinforced self-adhesive strip, 9 inches wide, with release film on adhesive side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection Course: Where shown, provide type recommended by waterproofing sheet-material manufacturer, unless another type is indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, and sound; ready to receive HDPE sheet.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch or 1/8 inch for heavy-duty deck paving waterproofing.
- F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing where applicable.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION COURSE INSTALLATION

- A. Install protection course with butted joints over waterproofing membrane before starting subsequent construction operations.
 - 1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 - 2. Flood each area for 48 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
- B. Owner will engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.6 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26

(3/06)

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Blanket type thermal building insulation.
 - 2. Blanket type sound attenuation insulation.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry".
 - 2. Division 9 Sections "Gypsum Board Assemblies" and "Gypsum Board Shaft-Wall Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation
 - b. Johns Manville Corp.
 - c. Owens Corning
- 2. Mineral Wool Insulation:
 - a. Rockwool
 - b. Owens Corning
 - c. Johns Manville Corp.
- 3. Rigid Insulation
 - a. Owens Corning
 - b. Johns Manville Corp.
 - c. CertainTeed
- 4. Closed-cell Spray Foam Insulation
 - a. Walltite by BASF
 - b. Johns Manville
 - c. SealTite Pro by Carlisle Spray Foam Insulation

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. R-Values:
 - a. 2x8 Exterior Walls: R-25 insulation.
 - b. 2x6 Exterior Walls: R-19 insulation.
 - c. 2x6 Interior Walls: R-19 insulation.
 - d. Roof framing: R-38 insulation, without Class 1 vapor retarder on the ceiling side of the unvented enclosed roof framing assembly.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Mineral-Fiber Blanket Insulation: Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Mineral-Fiber Blanket Insulation: Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 - 1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- C. Mineral-Fiber Blanket Insulation: Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
 - 1. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- D. Line Wire: Standard gauge as required to support blanket/batt insulation.

2.4 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation
 - 1. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.5 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1
 - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.6 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
 - b. Attic spaces.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.7 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Fire Propagation Characteristics: Passes NFPA 285 and NFPA 276 testing as part of an approved assembly.
3. Accessories:

- a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- 4. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 - a. Gypsum Wallboard: 0.5 inch minimum thickness
 - b. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.
 - c. 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: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 - d. Topcoat: 8 to 12 mil thick, water-based latex-based paint or heavy-duty protective coating recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.
- 5. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.
- 6. Mineral-Fiber Insulation: 1.5-inch minimum thickness.
- 7. Wood Structural Panel, Particleboard or Hardboard: 0.25-inch minimum thickness.
- 8. Gypsum Wallboard: 0.325-inch minimum thickness.
- 9. Corrosion-Resistant Steel: 0.016-inch base metal thickness.
- 10. Cellulose Insulation: 1.5-inch minimum thickness, self-supported spray-applied; for attic spaces only.
- 11. Ignition Barrier Coating: Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with ICC-ES AC377, Appendix X.
- 12. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with insulation installation.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
 - 1. Stuff loose glass fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume (to density of approximately 2.5 lbs. per cu. ft.)
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
- F. Prior to installing gypsum board, install sound attenuation blankets as indicated, unless readily installed after gypsum board has been installed.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions to envelope the entire area to be conditioned, including small pockets or holes that might allow a heat transfer between the room and conditioned space and the exterior. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Vapor barrier shall be free of gaps, openings, etc., which would allow passage of vapor from unprotected to protected spaces or volumes. Do not obstruct ventilation spaces, except for firestopping. Vapor retarder shall be continuous without gaps, rips or tears and shall be fastened to face of studs or joists.
- C. Set reflective foil-faced units with approximately $\frac{3}{4}$ " air space in front of foil face, when installed in substantial contact with unexposed surface of the ceiling, wall or floor finishes.
- D. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
- E. If insulation units are located in an unsupported ceiling area, provide line wire to support insulation units from dropping out from between supports. Space line wire at 16 " on center maximum.
- F. If insulation units are to be installed at the upper portion of the joists or rafters to eliminate the void between the roof deck and the conditioned cavity, use 5/8" staples and 18 gauge galvanized sag-wires.
- G. Contractors Option: Use Simpson "IS" insulation supports between joists and rafters. Comply with manufacturer's recommendation for installation requirements.
- H. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
1. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 2. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

3.5 INSTALLATION OF SPRAY FOAM INSULATION

A. Preparation:

1. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
2. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

B. Installation:

1. Comply with insulation manufacturer's written instructions applicable to products and applications.
2. Spray insulation to envelop entire area to be insulated and fill voids.
3. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
4. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
5. Cavity Walls: Install into cavities to [thickness indicated on Drawings] [fully fill void].
6. Miscellaneous Voids: Apply according to manufacturer's written instructions.
7. Install thermal barrier material.

8. Do not cover insulation prior to any required spray foam insulation inspections.
9. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
 - a. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 - b. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 - c. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 25 00 – WEATHER-RESISTIVE BARRIERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Weather barrier membrane
 - 2. Seam Tape
 - 3. Flashing
 - 4. Fasteners
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 REFERENCES

- A. ASTM International
 - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
 - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
 - 9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Association of Textile Chemists and Colorists

1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI

1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.4 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.

D. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
2. Manufacturer Instructions: Provide manufacturer's written installation instructions. Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing. (See Special Project Warrantee requirements below)
3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals

1. Refer to Closeout Submittals Section 01 77 00
2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, with a minimum of 3 years of experience installing like projects, who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

1. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
2. Source Limitations: Provide commercial weather barrier and accessory materials produced by single manufacturer.

B. Mock-up

1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
 - a. Mock-up size: [10 feet by 10 feet] [insert size].
 - b. Mock-up Substrate: Match wall assembly construction, including window opening.
 - c. Mock-up may [not] remain as part of the work.
2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting

1. Refer to Division 1 Section "Project Management and Coordination."
2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.
3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Product Requirements Section
- B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.7 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.8 WARRANTY

- A. Refer to Warranties Section

B. Special Warranty

1. Warranty period is 10 years after date of substantial completion. (*Project Close-out Item*)
2. Pre-installation meetings and jobsite observations by weather barrier manufacturer for warranty are required.
3. Warranty Areas: [Describe specific areas of work protected and areas of work excluded as required by project conditions].

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Air Barrier and auxiliary materials shall comply with the following system requirements:

1. Obtain air barrier and auxiliary materials as a single-source from the Air Barrier Manufacturer to ensure total system compatibility and integrity.
2. Air leakage:
 - a. ASTM E2357: Pass
 - b. CAN/ULC-S742-11: Classification A1
 - c. CAN/ULC S741-08
3. Water resistance:
 - a. AATCC TM127: Pass
 - b. ASTM E331: Pass
4. Nail Sealability:
 - a. AAMA 711-13, ASTM D1970: Pass

B. Acceptable Manufacturers:

1. Henry® Company
999 N. Sepulveda Blvd. Suite 800
El Segundo, CA 90245
(800) 486-1278
www.henry.com

2.2 MATERIALS

A. Primary Sheet-Applied, Vapor Permeable Water Resistive Air Barrier (Basis of Design):

1. Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:

- a. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier
- b. Color: Blue
- c. Thickness: 23 mils (0.58 mm)
- d. Water Vapor Permeance (ASTM E96): 29 perms
- e. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
- f. Air Permeance (ASTM E2178): Pass
- g. Nail Sealability (ASTM D1970): Pass
- h. Dry Tensile Strength (ASTM D882):
 - 1) 41 lbf /182N MD
 - 2) 29 lbf /129N CD
- i. Surface Burning Characteristics (ASTM E84):
 - 1) Flame Spread: Class A
 - 2) Smoke Development: Class A
- j. Low Application Temperature: 20 degrees F (-7 degrees C)

B. Assembly Auxiliary Materials:

1. Adhesives/Primers:

- a. Low VOC adhesive:
 - 1) Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
 - a) Basis of design: Henry® Blueskin® LVC Adhesive
 - b) Color: Blue
 - c) Maximum VOC: <240 g/L
 - d) Drying time (initial set): 30 minutes
 - e) Low Application Temperature: 10 degrees F (-12 degrees C)
 - 2) Polymer emulsion water based quick setting adhesive with low VOC content; having the following typical physical properties:
 - a) Basis of design: Henry® Aquatac™ Primer
 - b) Color: Aqua
 - c) Maximum VOC: 50 g/L
 - d) Drying time (initial set): 30 minutes
 - e) Low Application Temperature: 25 degrees F (-4 degrees C)

2.3 ACCESSORIES

A. Seam Tape: 3 inch wide, DuPont™ Tyvek® Tape for commercial applications.

B. Fasteners:

- 1. Tyvek® Wrap Caps, as distributed by DuPont: #4 nails with large 1-inch plastic cap fasteners, or 1-inch plastic cap staples with leg length sufficient to achieve a minimum penetration of 5/8-inch into the wood stud.

C. Sealants

- 1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.

2. Products:

- a. DuPont™ Commercial Sealant
- b. Sealants recommended by the weather barrier manufacturer.

D. Adhesives:

1. Provide adhesive recommended by weather barrier manufacturer.

2. Products:

- a. SIA 655
- b. Adhesives recommend by the weather barrier manufacturer.

E. Primers:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

- a. SIA 655
- b. Primers recommended by the flashing manufacturer

F. Flashing

- 1. DuPont™ FlexWrap™, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
- 2. DuPont™ FlexWrap™ NF, as distributed by DuPont: flexible membrane flashing materials for window openings and penetrations.
- 3. Preformed Inside and Outside Corners and End Dams as distributed by DuPont: Preformed three-dimensional shapes to complete the flashing system used in conjunction with DuPont™ Thru-Wall Flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 INSTALLATION – WEATHER BARRIER

- A. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

- B. Install weather barrier prior to installation of windows and doors.
- C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- D. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.
- E. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.
- F. Window and Door Openings: Extend weather barrier completely over openings.
- G. Overlap weather barrier
 - 1. Exterior corners: minimum 12 inches.
 - 2. Seams: minimum 6 inches.
- H. Weather Barrier Attachment:
 - 1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

3.3 SEAMING

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 OPENING PREPARATION

- A. Flush cut weather barrier at edge of sheathing around full perimeter of opening.
- B. Cut a head flap at 45-degree angle in the weather barrier at window head to expose 8 inches of sheathing. Temporarily secure weather barrier flap away from sheathing with tape.

3.5 THRU-WALL FLASHING INSTALLATION

- A. Apply primer per manufacturer's written instructions.
- B. Install preformed corners and end dams bedded in sealant in appropriate locations along wall.
- C. Starting at a corner, remove release sheet and apply membrane to primed surfaces in lengths of 8 to 10 feet.

- D. Extend membrane through wall and leave ¼ inch minimum exposed to form drip edge.
- E. Roll flashing into place. Ensure continuous and direct contact with substrate.
- F. Lap ends and overlap preformed corners 4 inches minimum. Seal all laps with sealant.
- G. Trim exterior edge of membrane 1-inch and secure metal drip edge per manufacturer's written instructions.
- H. Apply sealant bead at each termination.

3.6 THRU-WALL FLASHING / WEATHER BARRIER INTERFACE AT BASE OF WALL

- A. Overlap thru-wall flashing with weather barrier by 6-inches.
- B. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.
- C. Seal vertical and horizontal seams with tape or sealing membrane.

3.7 FIELD QUALITY CONTROL

- A. Notify manufacturer's designated representative to obtain [required] periodic observations of weather barrier assembly installation.

3.8 PROTECTION

- A. Protect installed weather barrier from damage.

END OF SECTION 07 25 00

SECTION 07 26 15 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Multi-component epoxy- or modified synthetic polymer-based (non-silicate) moisture-vapor emission and alkalinity control system for interior concrete slabs to receive finish flooring materials.
 - 2. Preparation of concrete slab prior to application of moisture-vapor emission control system.
 - 3. Installation of cementitious overlay after application of moisture-control emission system and successful post-installation moisture testing.
 - 4. Testing for concrete moisture-vapor emission and alkalinity levels.
 - a. Pre-installation.
 - b. Post-installation.
- B. Related Sections include:
 - 1. Section 03 30 05 "Underslab Vapor Barrier" for vapor barrier sheet membrane occurring below concrete slabs on grade.
 - 2. Section 09 65 16 "Resilient Flooring" for linoleum flooring installed over concrete slabs with moisture-vapor control system.

1.3 REFERENCES

- A. ASTM International (American Society for Testing and Materials):
 - 1. ASTM C 109: Test Method for Compressive Strength of Hydraulic Cement Mortars.
 - 2. ASTM D 1308: Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 - 3. ASTM D 4541: Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 4. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
 - 5. ASTM E 96: Test Methods for Water Vapor Transmission of Materials.
 - 6. ASTM F 710: Practice for Preparing Concrete Floors to Receive Resilient

Flooring.

7. ASTM F 2170: Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. Code of Federal Regulations (CFR):

1. 40 CFR, Part 59, Subpart D: National Volatile Organic Compound Emission Standards.

1.4 DEFINITIONS

A. VOC: Volatile organic compounds.

1.5 COORDINATION

A. Coordinate sequencing of installation of concrete moisture-vapor control system such that the length of time that system is left exposed prior to subsequent installation of finish flooring material is minimized. Protect system as specified in Part 3 "Protection" Article.

1.6 PREINSTALLATION MEETING

- A. Pre-installation Conference: Conduct conference at Project site to review pertinent issues related to installation of concrete moisture-vapor control system.
1. Attendees: Installer and representatives of moisture-vapor emission control system manufacturer, and other manufacturers and installers affected by installation of moisture-vapor control system.
 2. Agenda: Review methods and procedures, and outstanding issues related to moisture-vapor control system including, but not limited to, the following:
 - a. Condition of substrate and preparatory work.
 - b. Project conditions.
 - c. Requirements for protecting work, including restriction of traffic during installation period.
 - d. Manufacturer's installation instructions and warranty requirements.
 - e. Coordination with other work.
 - f. Protection of adjacent work.
 3. Document proceedings including corrective measures and actions required, and furnish copy of record to each participant.

1.7 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical data for concrete moisture-vapor control system, including cementitious overlay.
- B. Moisture-Vapor Emission and Alkalinity Testing: Submit procedure and reporting format for moisture-vapor emission and alkalinity tests.

1.8 INFORMATIONAL SUBMITTALS

- A. Installer's Qualification Data: Manufacturer's certification of Installer as approved installer of concrete moisture-vapor control system.
 - 1. Provide five project references.
- B. Product Test Reports: From a qualified independent testing agency indicating concrete moisture-vapor control system compliance with specified performance requirements.
- C. Product Certifications: Certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.
- D. Moisture-Vapor Emission and Alkalinity Test Reports: Submit test reports with results of testing for moisture-vapor emission and alkalinity levels in concrete slabs, as specified in Part 3 "Moisture Testing Procedures" Article.
 - 1. Pre-installation testing.
 - 2. Post-installation field quality control testing.
- E. Qualification Data: For testing agency.
- F. Sample Warranties: For special warranties.

1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain components and accessories of concrete moisture-vapor control system through one source from same manufacturer as concrete moisture-vapor control system, or as approved in writing by concrete moisture-vapor control system manufacturer.
- B. Manufacturer Qualifications: Company with minimum of 5 years experience in manufacturing non-silicate epoxy or modified polymer-based concrete moisture-vapor emission and alkalinity control products, with a record of successful in-service performance, and capable of providing field service representation during construction.
- C. Installer Qualifications: Authorized representative trained and approved in writing by manufacturer of concrete moisture-vapor control system.
- D. Testing Agency: Independent third-party agency with minimum of 5 years of demonstrated experience and capability to perform specified concrete moisture-vapor emission and alkalinity tests.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store materials in a dry, secure area protected from exposure to harmful weather conditions and at temperature levels as recommended by manufacturer.

1.11 FIELDCONDITIONS

- A. Moisture Testing: Conduct pre-installation and post-installation concrete moisture and alkalinity testing within temperature and relative humidity conditions as specified in Part 3 "Concrete Moisture and Alkalinity Testing" Article.
- B. At new concrete slabs, do not install concrete moisture-vapor control system until pre-installation concrete moisture and alkalinity test results have been reviewed, and concrete slab has cured and is in acceptable condition as determined by manufacturer of concrete moisture-vapor control system.
- C. Environmental Limitations: Comply with concrete moisture-vapor control system manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting system installation.
- D. Close spaces to traffic during application of concrete moisture-vapor control system during application, and for not less than 24 hours afterwards, unless manufacturer recommends longer period.

1.12 WARRANTY

- A. Special Warranty: Written non-prorated warranty as provided by manufacturer against failure of finish flooring system due to concrete moisture-vapor emission, alkalinity, and concrete adhesion failure. Warranty to include replacement of finish flooring material, flooring adhesive, concrete moisture-vapor control system, and all associated labor costs. Cracks and other issues relating to installation of concrete substrate are not justification for exclusion of coverage.
 - 1. Warranty Period: 10 years. Coverage includes the following:
 - a. Manufacturing defects.
 - b. Installation defects.
 - i) Signed by manufacturer-approved applicator.
 - c. Concrete moisture and alkalinity damage to floor coverings.
 - d. Failure to meet specified performance requirements.
 - 2. Warranty shall not exclude the following:
 - a. Cracks and other issues relating to installation of concrete substrate.
 - b. Upper limits for moisture-vapor levels as recorded by pre-installation testing.
 - c. Condensation or dew point issues.
 - d. Salts in concrete.
 - e. Pinholes in moisture-vapor control system.
 - f. Future removal and reinstallation of finish flooring.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Moisture-Vapor Emission Levels: Provide system capable of producing the following results in concrete slab:
 - 1. Reduce moisture level to a 75 percent maximum relative humidity, as verified by relative humidity testing using in situ probes in conformance with ASTM F 2170.
 - 2. Alkalinity level of not less than 7 and not more than 9 pH, as verified by testing per ASTM F 710.

2.2 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM

- A. Concrete Moisture-Vapor Control System: Multi-component, ultra-low-viscosity non-silicate epoxy or modified polymer-based liquid penetrant designed for penetrating concrete substrates to mechanically restrict water-vapor emission passage and alkalinity levels; capable of meeting specified performance requirements and filling concrete voids, cracks, and pinholes.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Moisture Control, Inc.; Vapor-Guard DC.
 - b. DiamondStone, LLC; Diamond-VRS.
 - c. Floor Seal Technology; MES 100.
 - d. Koster American Corporation; VAP 12000.
 - e. Synthetics International; Synthetic 30.
 - f. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. VOC Content: Provide concrete moisture-vapor system that complies with local regulatory limits for VOC content when calculated according to 40 CFR, Part 59, Subpart D (EPA Method 24).
 - 3. Microbial Resistance: Formulation shall be resistant to the growth of mold, mildew, and micro-organisms.
 - 4. Environmental Properties: Non-oil-based, non-corrosive, non-marine pollutant. Shall not contain harmful fumes or vapors when in a wet mixed or unmixed state.
 - 5. Physical Properties:
 - a. Concrete Adhesion: 350 psi minimum, or concrete cohesive failure when tested according to ASTM D 4541.
 - b. Water Vapor Transmission: Minimum 92 percent reduction when tested according to ASTM E 96.
 - c. Chemical Resistance: No effect when exposed to 14 pH alkali solution when tested according to ASTM D 1308 for acids/alkali.
 - 6. Acrylic, latex, sodium, lithium, potassium silicate formulations, and other single-

component products are not acceptable.

2.3 ACCESSORY MATERIALS

- A. Cementitious Overlay and Patching: Portland cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch and approved in writing by manufacturer of moisture-vapor control system.
 - 1. Product: Subject to compliance with requirements, provide one of the following:
 - a. Ardex; K-15 Self-Leveling Underlayment Concrete.
 - b. RAECO Specialty Cements, LLC; SLU.
 - c. Equal product in accordance with Division 1 requirements for product substitutions.
 - 2. Cement Binder: ASTM C 150, Portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.

PART 3 - EXECUTION

3.1 CONCRETE MOISTURE AND ALKALINITY TESTING

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform moisture testing as specified in this Article.
- B. Testing Conditions: Do not conduct moisture testing until final building environmental conditions have been achieved. Maintain temperature between 65 and 85 deg F, and relative humidity between 40 percent and 60 percent for not less than 72 hours prior to, and throughout duration of testing.
- C. Prepare concrete slab substrates prior to testing in accordance with referenced testing standards.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, coatings, and other substances that would preclude accurate test readings.
- D. Moisture-Vapor Emission Testing: Moisture testing shall be performed using relative humidity in-situ probe test method, conforming with ASTM F 2170.
 - 1. Level of moisture to be determined and reported as relative humidity (RH).
 - 2. After completion of testing, fill test probe holes with cementitious patching material.
- E. Alkalinity Testing: Testing shall utilize a calibrated digital 1-14 wide range pH meter and conform with requirements of ASTM F 710 for test procedure. Paper and pencil type tests are not acceptable.

- F. Quantity and locations of testing shall meet the following criteria, except that post-installation field quality control testing need not be performed on those areas that show moisture levels of less than 75 percent relative humidity, and a pH level of 7 to 9, in pre-installation moisture testing.
 - 1. Minimum of three tests for first 1,000 square feet.
 - 2. Minimum of one test for each additional 1,000 square feet.
 - 3. At slabs on grade, include at least one test within 3 feet of each exterior wall.
- G. Test reports shall include the following information:
 - 1. Name and address of structure.
 - 2. Description of testing instruments and methods. Include statement of justification for type of test instruments used; include copy of ASTM F 2170 and ASTM F 710 testing protocols.
 - 3. Date and time of measurements.
 - 4. Name, title, and affiliation of individual performing measurements.
 - 5. Floor plan with location of each test location clearly marked. Include the following information.
 - a. Moisture Tests:
 - i) Locations and depths of probe holes within the structure.
 - ii) Relative humidity in each probe hole, to the nearest percent relative humidity.
 - iii) Temperature in each probe hole to the nearest degree F.
 - iv) Ambient air temperature, to the nearest degree F, and relative humidity to the nearest percent above each probe hole.
 - v) Make, model, and last calibration date of instrument used to make measurements.
 - b. Alkalinity Tests:
 - i) Location of each test.
 - ii) pH level of each test.
 - 6. Any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.

3.2 EXAMINATION

- A. Pre-installation Concrete Moisture and Alkalinity Testing: Conduct pre-installation concrete moisture and alkalinity testing of existing concrete slabs as specified in "Concrete Moisture and Alkalinity Testing" Article, on all interior concrete slab areas to receive finish flooring.
 - 1. Allow new concrete to cure for a minimum of 14 days.
 - 2. After reviewing results of pre-installation concrete moisture and alkalinity testing of concrete slab areas to receive finish flooring, meet with Architect and Construction Manager to determine areas to receive moisture-vapor control

system.

3. Those slab areas that show moisture levels of less than 75 percent relative humidity, and a pH level of 7 to 9 need not be treated with concrete moisture-vapor control system, and may be deducted from scope of work by way of Change Order, if so directed by Construction Manager.
- B. Examine concrete substrates, with Installer present, for compliance with requirements for installation of concrete moisture-vapor and alkalinity control system. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Mask and protect adjacent surfaces from the effects of dust and splashing of materials associated with preparation and installation of concrete moisture-vapor control system.
- B. Surface Preparation: Scarify existing concrete slab surfaces to receive system treatment by shot blasting and as recommended in writing by manufacturer of moisture-control system. Acid etching is not allowed.
1. Newly poured slabs do not require scarification. Allow minimum cure time prior to application of concrete moisture-vapor control system as required by manufacturer.
- C. Crack and Joint Preparation: Mechanically open, vacuum, and seal all cracks and joints with moisture-control system component material, and then fill with 100 percent portland cement-based patching compound, as recommended in writing by manufacturer of concrete moisture-vapor control system.
- D. If necessary, place dehumidifiers in locations and for time period as required to achieve ambient humidity conditions in conformance with manufacturer's written recommendations.

3.4 CONCRETE MOISTURE-VAPOR CONTROL SYSTEM APPLICATION

- A. Apply concrete moisture-vapor control system in accordance with manufacturer's written instructions. Saturate concrete surfaces, cracks, and joints.
1. Apply penetrants and coatings by squeegee and roller application to saturate concrete surfaces.
 2. Conform with manufacturer's requirements for coverage rates and number of applications as needed to meet specified performance requirements.
- B. After application and curing of moisture-vapor control material, and post-installation concrete moisture and alkalinity testing with satisfactory results is complete, install cementitious overlay at those areas to receive resilient finish flooring materials. Install in accordance with manufacturer's written instructions, to minimum thickness of 1/16 inch and as otherwise required to provide a smooth and continuous substrate suitable to receive finish flooring materials without the use of special adhesives or patching compounds.
1. Refer to "Field Quality Control" Article for post-installation concrete moisture and alkalinity testing requirements to be fulfilled prior to installation of

cementitious overlay.

3.5 FIELD QUALITY CONTROL

- A. Conduct post-installation moisture and alkalinity testing for concrete moisture-vapor emissions and alkalinity in presence of concrete moisture-vapor control system manufacturer's representative and as specified in "Concrete Moisture and Alkalinity Testing" Article, at those areas receiving concrete moisture-vapor control system, prior to installation of cementitious overlay. Verify the following results:
 - 1. Moisture level of 75 percent relative humidity or less.
 - 2. Alkalinity level of 7 to 9 pH.
- B. If test results do not meet specified performance requirements, apply additional concrete moisture-vapor emission control material, or take other corrective action as recommended by manufacturer of concrete moisture-vapor control system to meet requirements.
 - 1. Additional concrete moisture and alkalinity testing, at Contractor's expense, to be performed to determine compliance of replaced or additional work with specified requirements.

3.6 PROTECTION

- A. Protect concrete moisture-vapor control system, and cementitious overlay from damage and surface moisture during time prior to installation of finish flooring materials.

END OF SECTION 07 26 15

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 26 16 BELOW GRADE VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

- A. Products supplied under this section:
 - 1. Vapor barrier and installation accessories for installation under concrete slabs.
- B. Related sections:
 - 1. Section 03 30 00 Cast-in-Place Concrete
 - 2. Section 07 26 00 Vapor Retarders

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
 - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 - 2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

- A. Quality control/assurance:
 - 1. Summary of test results per paragraph 9.3 of ASTM E1745.
 - 2. Manufacturer's samples and literature.
 - 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 - 4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all of the following qualities:

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
2. Or preapproved equal.

2.2 ACCESSORIES

A. Seams:

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Sealing Penetrations of Vapor barrier:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries LLC, (877) 464-7834
 - a. Stego Term Bar by Stego Industries LLC, (877) 464-7834
3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834

D. Penetration Prevention:

1. Beast Foot by Stego Industries LLC, (877) 464-7834

E. Vapor Barrier-Safe Screed System

1. Beast Screed by Stego Industries, LLC, (877) 464-7834

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instructions.
 - OR
 - b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into Beast Foot. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier
 7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
 8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
 9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
 10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Asphalt shingles.
 - 2. Sheet underlayment.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for roof deck wood structural panels.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings and counter-flashings not part of this Section.
 - 3. Division 7 Section "Roof Accessories".

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

- A. Product Data: Technical product data, installation instructions, and recommendations from shingle manufacturer, including data that materials comply with requirements.
- B. Samples for Initial Selection: Two samples for each type of asphalt shingle, ridge and hip cap shingles indicated.
 - 1. Include similar Samples of trim and accessories involving color selection.
- C. Samples for Verification: For the following products, of sizes indicated, to verify color selected.
 - 1. Asphalt Shingle: Full-size asphalt shingle strip.
 - 2. Ridge and Hip Cap Shingles: Full-size ridge and hip cap asphalt shingle.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

- E. Research/Evaluation Reports: For asphalt shingles.
- F. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain ridge and hip cap shingles felt underlayment through one source from a single asphalt shingle manufacturer.
- B. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- C. Pre-installation Conference: Conduct conference at Project, with Architect, Contractor, Owners Representative and others affected by this work, prior to commencement of application.
- D. Comply with CBC 2019 for Roofs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.
 - 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

- A. Substrate: Proceed with shingle work only after substrate construction and penetrations have been completed.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.
 - 1. Install sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.
 - 1. Material Warranty Period: 25 years from date of Substantial Completion, prorated, with first 3 years non-prorated. *(Project Close-Out Item)*
 - 2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 60 mph for 5 years from date of Substantial Completion. *(Project Close-Out Item)*
- B. Special Project Warranty: Roofing Installer's warranty, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion. *(Project Close-Out Item)*

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 2% of each type, in unbroken bundles. Obtain written verification of delivery from Owner. *(Project Close-Out Item)*

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
- B. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. 3-Dimensional Laminated-Strip Shingle, UL Class "A": Mineral-surfaced, self-sealing, laminated, multi-ply overlay construction, glass-fiber based strip shingle complying with ASTM D 3018, Type 1, and with ASTM D 3462.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation, "Landmark Pro"
 - b. Or approved equal.

2. Color and Blends: "**Weathered Wood**", to match existing shingled roofs on site. Or as selected by Architect from manufacturer's full range depending on availability.

- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles or Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch.

2.3 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D226, D4869, or D6757, Type I, asphalt-saturated organic felts, No. 15, nonperforated, 36 inch wide, approximate weight of 18/lbs/square.
- B. Composite underlayment: CertainTeed WinterGuard Waterproofing Shingle Underlayment or approved equivalent meeting ASTM D1970.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: Fibrated asphalt cement complying with ASTM D 4586, designed for trowel applications, asbestos free.
- B. Roofing Nails: Hot-dip galvanized steel wire shingle nails, minimum 12 gage, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or to penetrate through to plywood sheathing.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

2.5 METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 1. Metal Drip Edge Sheet Metal: Minimum 26 gage, hot dipped galvanized sheet metal. Brake formed as indicated on drawings. Furnish in 8 foot to 10 foot lengths.
 2. Metal Flashing: Minimum 26 gage, hot dipped galvanized sheet metal. Job cut to sizes and configurations required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Option 1: On low slopes (2" to 4" per foot), one layer of WinterGuard Waterproofing Shingle Underlayment, lapped 19" over entire roof.
- B. Option 2: Double-Layer Felt Underlayment: Install double layers of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Install an 18-inch- wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 19 inches in shingle fashion. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails in compliance with CBC 2019.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim" and in compliance with details and CBC 2013:
- B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. Install asphalt shingles according to manufacturer's written instructions, and CBC 2013.
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed with self-sealing strip face up at roof edge.
1. Extend asphalt shingles 1/2 inch over fascia at eaves and rakes.
 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

- D. Fasten asphalt shingle strips in pattern and with number of fasteners per shingle recommended by manufacturer's written instructions and CBC 2013.
- E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.
 - 1. Set valley edge of asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
 - 2. Do not nail asphalt shingles to metal open valley flashings.
- F. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

3.5 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS (**Insert name**) of (**Insert address**), herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: (**Insert name of Owner.**)
 - 2. Address: (**Insert address.**)
 - 3. Building Name/Type: (**Insert information.**)
 - 4. Address: (**Insert address.**)
 - 5. Area of Work: (**Insert information.**)
 - 6. Acceptance Date: (**Insert date.**)
 - 7. Warranty Period: (**Insert time.**)
 - 8. Expiration Date: (**Insert date.**)
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 80 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and

- g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 - 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5. During Warranty Period, if original use of roof is changed, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 - 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this **(Insert day)** day of **(Insert month)**, **(Insert year)**.
- 1. Authorized Signature: **(Insert signature.)**
 - 2. Name: **(Insert name.)**
 - 3. Title: **(Insert title.)**

(Project Close-Out Item)

END OF SECTION 07 31 13

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - 1. Manufactured reglets.
 - 2. Formed roof drainage system.
 - 3. Formed low-slope roof flashing and trim.
 - 4. Formed steep-slope roof flashing and trim.
 - 5. Formed wall flashing and trim.
 - 6. Formed equipment support flashing.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 7 Section "Asphalt Shingles" for installing sheet metal flashing and trim integral with roofing.
 - 3. Division 7 Section "Membrane Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
 - 4. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 5. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: Two - 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim: Two - 12 inches long. Include fasteners and other exposed accessories.
 - 3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products specified.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 - 1. Mill Finish: Standard two-sides bright.
 - 2. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
 - 3. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 4. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.
 - 5. Anodized Finish: Apply the following coil-anodized finish:
 - a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - b. Class I, Color Anodic Finish: AA-M12C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating:

Architectural Class I, electrolytically deposited color coating 0.018 mm or thicker)
complying with AAMA 611.

- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - 1. Finish: No. 2D (dull, cold rolled).
- C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting.

2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft..

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - 4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
 - I. Building Paper Flashing: 6 inch wide by 15 pound Kraft paper flashing.
 - J. Elastic Sheet Flashing/Membrane: Non-reinforced flexible, black elastic sheet flashing of 50 to 65 mils thickness and complying with the following:
 - 1. Shore Hardness - (ASTM D 2240) 50 to 70.
 - 2. Tensile Strength - (ASTM D 412) 1200psi.
 - 3. Tear Resistance - (ASTM D 624, Die C) 20 lbs. per linear inch.
 - 4. Ultimate Elongation - (ASTM D 412) 250 percent.
 - 5. Low Temperature Brittleness - (ASTM D 746) minus 30 deg. F.
 - 6. Resistance to Ozone Aging – (ASTM D 1149) no cracks for 10 percent elongation sample 100 hours in 50 pphm (50.5mPa) Ozone at 104 deg. F.
 - 7. Resistance to heat Aging – (ASTM D 573) maximum hardness increase of 15 points, elongation reduction of 40 percent and tensile strength reduction of 30 percent, for 70 hours at 212 deg.F.
 - 8. Acceptable Products:
 - a. Neoprene synthetic rubber sheet.
 - b. EPDM synthetic rubber sheet.
 - K. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, non-corrosive.
 - L. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.
- 2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM
- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.
- 2.6 FABRICATION, GENERAL
- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
 - B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
 - 1. Material: As indicated.
 - 2. Gutter Style: As detailed.
 - 3. Expansion Joints: As indicated or detailed.
 - 4. Accessories: Wire ball downspout strainer.
 - 5. Material Thickness: Refer to SMACNA "Architectural Sheet Metal Manual." For minimum material thickness.
- B. Downspouts: Fabricate round or rectangular, as indicated, downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Material and thickness: As indicated.
 - 2. Manufactured Hanger Style: As indicated.
 - 3. Fabricate downspouts from the following material:

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from material and thickness as indicated.
- B. Valley Flashing: Fabricate from material and thickness as indicated.
- C. Drip Edges: Fabricate from material and thickness as indicated.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from material and thickness as indicated.
- E. Base Flashing: Fabricate from material and thickness as indicated.
- F. Counterflashing: Fabricate from material and thickness as indicated.
- G. Flashing Receivers: Fabricate from material and thickness as indicated.
- H. Roof-Penetration Flashing: Fabricate from material and thickness as indicated.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from material and thickness as indicated.

2.10 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Aluminum: Use aluminum or stainless-steel fasteners.
 - 3. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for

installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
 2. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
 1. Connect downspouts to underground drainage system, unless otherwise indicated.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers, unless otherwise indicated.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers, unless otherwise indicated.
 2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers, unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets: Installation of reglets as indicated and shown on the drawings.
- C. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 6 inches beyond wall openings or as indicated on the drawings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.
- B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

- C. Elastic Flashing: Install Elastic Flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 60 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for which the type and form is indicated on the drawings.
 - 1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 2. Exterior joints in horizontal traffic surfaces:
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 4. Interior joints in horizontal traffic surfaces:
- B. Related Sections include the following:
 - 1. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 2. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

- E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- F. Qualification Data: For Installer and testing agency.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

(Project Close-Out Item)

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Products:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Silicones; Sanitary SCS1700.
 - c. Tremco; Tremsil 200.
 - d. Pecora Corporation; 863 Silicone
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

E. Multicomponent Pourable Urethane Sealant:

1. Products:
 - a. Meadows, W. R., Inc.; POURTHANE.
 - b. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type I (Self Leveling).
 - c. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
 - d. Pecora Corporation; Urexpan NR-200.
 - e. Tremco; THC-901.
 - f. Tremco; THC-900.
 - g. Tremco; Vulkem 245.
2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

F. Single-Component Nonsag Urethane Sealant:

1. Products:
 - a. Bostik Findley; Chem-Calk 900.
 - b. Bostik Findley; Chem-Calk 915.
 - c. Bostik Findley; Chem-Calk 916 Textured.
 - d. Bostik Findley; Chem-Calk 2639.
 - e. Pecora Corporation; Dynatrol I-XL.
 - f. Tremco; DyMonic.
 - g. Tremco; Vulkem 921.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type OP, Grade NF.

B. Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Sonneborn, Division of ChemRex Inc.; Sonolac.
4. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. Flame-spread and smoke-developed indexes of less than 25 per ASTM E 84.
3. Products:

- a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products:
 - a. Pecora Corporation; BA-98.
 - b. Tremco; Tremco Acoustical Sealant.

2.6 FIRE RESISTANT JOINT SEALERS

A. General: Provide manufacturer's standard sealant and accessory materials with fire-resistance rating indicated which are identical to those of assemblies whose fire endurance has been determined by testing per ASRM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Foamed in Place Fire Stopping Sealant: Two part, foamed-in-place, silicone sealant formulated for use as part of a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.

1. Products:
 - a. Dow Corning Corporation; Dow Corning Fire Stop Foam.
 - b. Hilti, Inc. CP620 Fire Foam.
 - c. Specified Technologies, Inc.; SSS100.

- C. One Part Fire Stopping Sealant: One part elastomeric sealant formulated for use as a part of a through penetration fire stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.

1. Products:

- a. Dow Corning Corporation; Dow Corning Fire Stop Sealant.
- b. Electrical Products Division/3M Corporation; 3M Fire Barrier Caulk CP25WB+.
- c. Hilti, Inc. FS-One high performance intumescent firestop sealant.

2.7 JOINT FILLERS FOR CONCRETE PAVING

- A. General: Provide joint fillers of thickness and widths indicated.

1. Self-Expanding Cork Joint Filler: Preformed strips complying with ASTM D1752 for Type III.
2. Sponge Rubber Joint Filler: Preformed strips complying with ASTM D1752 for Type I.

2.8

2.8 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
 - H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
 - I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
 1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.
 - J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.
 - K. Installation of Fire Stopping Sealant: Install sealant, including forming, packing and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs.
- 3.4 CLEANING
- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- 3.5 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

GENERAL

1.1 SUMMARY

- A. Section Includes: Work under this section comprises of furnishing hollow metal doors and frames, including transom frames, sidelight and window frames with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled.

Flush Steel Doors.

2. Steel frames.
 3. Hollow Metal Framing Systems.
- B. Related Sections: Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section. The latest published edition of each reference applies.

Section 06 10 00 - Rough Carpentry

2. Section 08 14 00 - Wood Doors
3. Section 08 71 00 - Door Hardware
4. Section 08 80 00 - Glazing

References: The intent of this document is that all hollow metal and its application will comply or exceed the standards identified below. The latest published edition of each reference applies.

1. ANSI - American National Standards Institute - ansi.org
2. NFPA - National Fire Protection Association
 - a. NFPA 80 - Standard for Fire Doors and Other Opening Protectives
 - b. NFPA 101 – Life Safety Code
 - c. NFPA 105 – Standard Smoke Door Assemblies and Other Opening Protectives
 - d. NFPA 252 - Standard Method of Fire Tests of Door Assemblies.
3. DHI - Door and Hardware Institute – Door Security + Safety Professionals
 - a. Installation Guide for Doors and Hardware.
 - b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
 - c. Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
4. SDI - Steel Door Institute
 - a. SDI-105 – Recommended Erection Instructions for Steel Frames
 - b. SDI-107 – Hardware on Steel Doors (Reinforcement - Application)
 - c. SDI-111 - Recommended Details for Standard Steel Doors, Frames, Accessories, and Related Components
 - d. SDI-117 - Manufacturing Tolerances Standard Steel Doors and Frames
 - e. SDI-118 – Basic Fire Door Requirements
 - f. SDI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames
 - g. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors

- h. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
 - i. SDI A250.8 - SDI-100 Specifications for Standard Steel Doors and Frames
 - j. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
 - k. SDI A250.11 - Recommended Erection Instructions for Steel Frames
 - l. SDI A250.13 Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies
- 5. BHMA - Builders Hardware Manufacturers Association
 - a. BHMA A156.115 - Hardware Preparations in Standard Steel Doors and Frames.
 - b. BHMA A156.7 - Hinge Template Dimensions.
- 6. ASTM - American Society for Testing Materials
 - a. ASTM A568/A568M-19a Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
 - b. ASTM A879/A879M-12(2017) Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - c. ASTM A653/A653M-19a Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - d. ASTM A924/A924M-19 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - e. ASTM A1008/A1008M-18 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- 7. ICC - International Code Counsel
 - a. ICC A117.1 – Accessible and Usable Building and Facilities.
 - b. ICC 500 Standard for the Design and Construction of Storm Shelters
- 8. UL - Building Materials Directory; Underwriters Laboratories Inc.
 - a. UL 10B - Standard for Neutral Pressure Fire Tests of Door Assemblies
 - b. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies
 - c. UL 1784 – Air Leakage Test of Door Assemblies
 - d. UL 752 – Standard for Bullet-Resisting Equipment
- 9. NAAMM/HMMA – National Association of Architectural Metal Manufacturers/Hollow Metal Manufacturers Association
 - a. NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
- 10. WH - Certification Listings; Warnock Hersey International Inc.
- 11. Federal Emergency Management Agency (FEMA) 361 Guidelines, ICC500 - 2014
- 12. Miami - Dade County test protocols PA 201, PA 202 and PA 203.
- 13. Florida Building Code test protocols TAS 201, TAS 202 and TAS 203.
- 14. Texas Department of Insurance TDI - Complies with TAS 201, TAS 202 and TAS 203, Large Missile Impact.

1.2 SUBSTITUTIONS:

- A. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and their consultant

SUBMITTALS

- A. Submittals to comply with provisions of Division 01, Submittal Procedures.
- B. Product Data: Manufacturer's standard details and catalog data indicating compliance with referenced standards and manufacturer's installation instructions.
- C. Shop Drawings: Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Shop drawings should include the following information to ensure doors and frames are properly prepared and coordinated to receive hardware.
 - 1. Elevations of each door and frame type.
 - 2. Details for door core.
 - 3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 4. Locations of cutouts for glass and louvers.
 - 5. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 6. Mounting locations for hardware.
 - 7. Thickness of reinforcement/preparations for hardware.
 - 8. Details of anchorages, joints, field splices, and connections.
 - 9. Details of accessories.
 - 10. Details of moldings, removable stops, and glazing.
 - 11. Fire ratings.
 - 12. Finish.

Samples: 12 by 12 inches (304 mm by 304 mm) cut away sample door with provisions for lockset, hinge and corner section of frame welded and prepped for specified hardware. Sample should be furnished with submittals for Owner approval. After approval return sample to door/frame supplier as confirmation of approved construction.

- E. Closeout Submittals to comply with Division 1, Closeout Submittals procedures.
- F. Furnish copies of manufacturer's warranty information and maintenance instructions.

QUALITY ASSURANCE

- A. Hollow Metal Distributor is to be a direct account of the manufacturer of the products furnished. In addition, that distributor must have in their regular employment an Architectural Hardware Consultant (AHC), Certified Door Consultant (CDC), an Architectural Openings Consultant (AOC), a Door & Hardware Consultant (DHC) or equivalent door and hardware industry experience who will be available to consult with the Architect and Contractor regarding any matters affecting the door and frame opening.
- B. Manufacturer Qualifications: Certified Member of the Steel Door Institute in good standing.
- C. Installer: Minimum five years documented experience installing products specified this Section.
- D. Certificates:
 - 1. Manufacturer's certification that products comply with referenced standards.
 - 2. Hollow Metal Manufacturer must provide documentation that they are an SDI Certified Manufacturer.

Fire Rated Doors and Frames: Underwriters' Laboratories, Intertek Testing Services/Warnock Hersey, and Factory Mutual labeled fire doors and frames:

- 1. Provide labeled fire doors and frames in accordance with Underwriters Laboratories standard UL10C Positive Pressure Fire Tests of Door Assemblies.
- 2. Construct and install doors and frames to comply with current issue of NFPA 80.
- 3. Manufacture Underwriters' Laboratories labeled doors and frames in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.

4. Manufacture Intertek Testing Services /Warnock Hersey labeled doors and frames in strict compliance to ITS/WH procedures and provide the degree of fire protection capability indicated by the opening class.
5. Manufacture Factory Mutual labeled doors and frames in strict compliance to FM procedures, and provide the degree of fire protection, heat transmission and panic loading capability indicated by the opening class.
6. Affix a physical label or approved marking to each fire door and/or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
7. Conform to applicable codes for fire ratings. It is the intent of this specification that doors, frames, hardware and their application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.
8. Provide Temperature Rise Fire Door Assemblies in exit enclosures and exit passageway with maximum transmitted temperature end point rating of not more than 250 degrees F (121 degrees C) above ambient at the end of 30 minutes of the standard fire test exposure.
9. For openings required to be fire rated exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.

DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided to prevent rust or damage.
2. Provide cardboard wrapped or crated product to provide protection during transit and job site storage
3. Should wrappers become wet, remove immediately

B. Delivery and Site Acceptance

1. The supplier shall deliver all materials to the project site; direct factory shipments are not allowed unless agreed upon beforehand. Supplier shall coordinate delivery times and schedules with the contractor.
2. Deliver doors cardboard wrapped or crated to provide protection during transit and job site storage. Provide additional protection to prevent damage to any factory-finished doors. Mark all doors and frames with architects opening numbers as shown on the contract documents and shop drawings on the center hinge preparation location.
3. Upon delivery, check in doors and frames jointly with supplier. Inspect doors and frames upon delivery for damage, correct quantities or shortages. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect. Otherwise, remove and replace damaged goods as directed. Note shortages and replace immediately.

C. Storage and Protection

1. Handle, store and protect products in accordance with the manufacturers printed instructions, ANSI/SDI A250.8 – Specifications for Standard Steel Doors and Frames, A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames, or ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames and NAAMM/HMMA 840 – Guide Specification for Receipt, Storage, and Installation of Hollow Metal Doors and Frames.
2. Store all materials in a dry area. All hollow metal material shall be stored so that it does not come in contact with water or moisture. Protect units from adverse weather elements.
3. Place units on 4 inch (102 mm) high wood sills to prevent rust and damage.

4. Store doors vertically under a properly vented cover, five units maximum in a stack with a ¼" space between doors to permit air circulation.
5. Store frames in an upright position with heads uppermost under cover.
6. Store assembled frames five units maximum in a stack with 2-inch (51 mm) space between frames to permit air circulation.

COORDINATION

- A. Coordinate Work with other directly affected sections involving manufacture or fabrication of internal cutouts and reinforcement for door hardware, electric devices and recessed items.
- B. Coordinate Work with frame opening construction, door and hardware installation.
- C. Sequence installation to accommodate required door hardware.

Verify field dimensions for factory assembled frames prior to fabrication.

1.7 WARRANTY

- A. Comply with Division 01 Closeout Submittals
- B. All doors and frames shall be warranted in writing by the manufacturer against defects in materials and workmanship for a period of one (1) year commencing on the date of manufacture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design - Metal Products Inc. (MPI), Corbin, KY (606) 523-0461 (Web: www.metalproductsinc.com)
 1. Exterior Doors: Polyurethane Doors, Tech 302
 2. Acceptable Alternate:
 - a. 707 Series (QMAX) by Curries Assa Abloy
 - b. Legion by Ceco Door Assa Abloy

- B. Provide all steel doors and frames from a single SDI certified manufacturer.

2.2 General:

- A. Physical performance: Units shall comply with the 1 million cycles swing test requirement per ANSI A250.4 - Level A.
- B. Finishing:
 1. Prime Gray to meet SDI A250.10
 2. Standard Color (on Galv doors and frames only) to meet SDI A250.3

DOORS

- A. General: Construct exterior/interior doors to the following designs and gauges:

Exterior Doors: Doors shall be made of commercial quality, level, cold rolled steel conforming to ASTM Designation A1008 and free of scale, pitting, or other surface defects. Face sheets shall be not less than 16 gauge.

- a. Door Thickness: 1-3/4 inches.
- b. Steel stiffened.
- c. Core: Rigid Pre-formed Closed Cell Polyisocyanurate Board
- d. Thermal Value: U-factor = 0.38 (Minimum U-factor = 0.50)

2. Interior Doors - Cold-rolled steel, ASTM A 1008/A 1008M:
 - a. Door gauge: 16 gauge
 - b. Door Thickness: 1-3/4 inches
 - c. Core: Rigid pre-formed closed cell polyisocyanurate (polyurethane) board, 2 lb. density average, Conforming to ASTM D2856. Core U-factor = 0.100, R-value – 10.0.
 - d. Face sheets: 16 ga.
 - e. U-factor: 0.38

DOOR FRAMES

- A. General: Construct exterior/interior metal door frames to the following designs and gauges;

Exterior Frames: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M:

- a. Thickness:
 - 1) 14 gauge.
2. Interior Frames in stud wall construction: cold rolled steel, ASTM A 1008/A 1008M.
 - a. Thickness:
 - 1) 14 gauge.
3. Interior KD Drywall Frames (Slip-On construction): cold rolled steel, ASTM A 1008/A 1008M.
 - a. Thickness:
 - 1) 14 gauge.

Steel Frames:

1. Basis of Design: Standard 3 Side Frames, Tech 201 by MPI (Metal Products Inc.)

Profile:

- a. Face:
 - 1) 2 Inches face dimension and types and throat dimensions indicated on the Door Schedule.
- b. Stops:
 - 1) Standard 5/8-inch-high stops
 - 2) Kerf style stops: 5/8-inch-high stops w/ 1/8-inch kerf slot positioned in the side of the stop.
 - 3) Thermal break w/ kerf stops: 5/8 inch-high stops. Steel used to make the stop on the frame will connect to the steel on the rabbet through a material that allows for a thermal break. A kerf slot for gasketing to be built into the thermal break.
3. Provide reinforcements and accessories for specified hardware per SDI 250.6.
4. Anchors: Locate adjustable anchors in each jamb 6 inches from the top of the door opening to hold frame in rigid alignment.

Exposed fastener type; recessed hole at base of jamb for countersunk fastener installation.

- b. Snap in base anchors
- c. Strap anchors welded to frame

Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

- C. Steel Frames for Drywall:

Profile:

- a. Face:
 - 1) 2 Inches face dimension and types and throat dimensions indicated on the Door Schedule.
 - 2) Custom special face dimension and types and throat dimensions indicated on the Door Schedule.
- b. Stops:
 - 1) Standard 5/8-inch-high stops
 - 2) Kerf style stops: 5/8-inch-high stops w/ 1/8-inch kerf slot positioned in the side of the stop.
2. Provide reinforcements and accessories for specified hardware per SDI 250.6.
3. Anchors: Locate adjustable anchors in each jamb 6 inches from the top of the door opening to hold frame in rigid alignment.

Exposed fastener type; recessed hole at base of jamb for countersunk fastener installation.

- b. Snap in base anchors
- c. Strap anchors welded to frame

Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

2.5 HOLLOW METAL FRAMING SYSTEMS

Hollow Metal Framing Systems:

1. Components: Construct architectural stick frame assemblies of standard frame components, fabricated as specified.
 - a. Exterior Frame Material: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 14 gauge galvanized steel.
 - b. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel (A40) (A60) or Zinc-Coated Galvanized steel (G90) that conforms to ASTM A 653/A653M, 16 gauge galvanized steel.

Interior Frames in stud wall construction: 16 gauge cold rolled steel, ASTM A 1008/A 1008M steel.

- d. Include galvanized components and internal reinforcements with galvanized frames.
2. Frame component requirements:
 - a. Prepare required sticks at door openings and frame assemblies for hardware as specified in Section 087100.
 - b. Fabricate frame assemblies from three basic components:
 - 1) Open Sections (perimeter members) identical in configuration to standard frames.
 - 2) Closed sections (intermediate members) with identical jamb depth, face dimensions, and stops as open sections.
 - 3) Sill sections: To be flush with both faces of adjacent vertical members. Cut individual components to length and notched to assure square joints and corners.
 - c. Externally welded face joints at meeting mullions or between mullions and other frame members on the face surfaces only. Grind and finish face joints smooth.
 - d. Fabricate frame assemblies for shipment to the jobsite completely welded.

- 1) Field joints permissible only when the size of the total assembly exceeds shipping limitations.
- 2) Fabricate oversized frames in sections designated for splicing in the field.
- e. Pierced and dimpled glazing beads for use with manufacturers' standard fasteners.
- f. Provide necessary anchors for jambs, heads, and sills of assemblies.
- g. Verify field dimensions as required. Do not begin fabrication until these dimensions have been verified and approved.

3. Accessories:

Glazing Bead: Formed steel sheet; screw-attached.

- b. Steel Panels:
 - 1) 1/2-inch – 1 inch thick and manufactured from 18 gauge **or** 16 gauge thick non-galvannealed or galvannealed steel faces with a polystyrene core.
 - 2) 1-3/4 inches thick and manufactured from 18 gauge **or** 16 gauge thick non-galvannealed or galvannealed steel faces with a steel stiffened core for fire rated openings.

Fire Rating: Provide factory assembled welded units bearing Labels for fire ratings indicated on the Drawings.

ACCESSORIES

- A. Anchors: Manufacturer's standard framing anchors, specified in manufacturer's printed installation instructions for project conditions.
- B. Astragals for pairs of doors: Manufacturer's standard for labeled and non-labeled openings.
- C. Plaster Guards: Same material as door frame, minimum 24 gauge (0.5 mm) minimum; provide for all strike boxes. Plaster guards not mandatory on interior after set frames.
- D. Silencers: Resilient rubber, Inserted type, three per strike jamb for single openings. Stick-on silencers shall not be permitted except on hollow metal framing systems.
- E. Glazing: Specified in Section 088000.

FABRICATION

- A. Steel Frames:
 1. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - a. Clearances shall comply with the requirements of NFPA 80.
 2. Three-piece knock-down frames: Head and jamb intersecting corners die-cut, mitered at 45 degrees, with locking tabs for rigid connection when assembled.
 3. Factory-welded frames: Head and jamb intersecting corners mitered at 45 degrees, with back welded joints ground smooth.
 - a. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.
 - b. Externally weld, grind, prime paint, and finish smooth face joints at meeting mullions or between mullions and other frame members per a current copy of ANSI/SDI A250.8.
 4. Provide temporary steel spreaders (welded to the jambs at each rabbet of door openings) on welded frames during shipment. Remove temporary steel spreaders prior to installation of the frame.

- B. Tolerances shall comply with SDI-117 "Manufacturing Tolerances for Standard Steel Doors and Frames."
- C. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold-rolled or hot-rolled steel sheet.
- D. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
- E. Reinforce doors and frames to receive surface-applied hardware per SDI A250.6. Drilling and tapping for surface-applied hardware shall be done at Project site. Provide internal reinforcements for all doors to receive door closers and exit devices where scheduled.
- F. Locate hardware as indicated on Shop Drawings or, if not indicated, per the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2.8 FINISHES

- A. Chemical Treatment: Treat steel surfaces to promote paint adhesion.
- B. Exposed door and frame surfaces to be cleaned and treated then coated with rust inhibitive primer. Water-based primer and color paint finishes to be free of Hazardous Air Pollutants (HAPS) and Volatile Organic Compounds (VOCs). Paint to comply with ANSI A250.3 and A250.10.

PART 3 EXECUTION

3.1 EXAMINATION

Verify that project conditions are acceptable before beginning installation of frames.

- 1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
 - 2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
- B. Do not begin installation until conditions have been properly prepared.
- C. Correct unacceptable conditions before proceeding with installation.

3.2 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's printed installation instructions and with Steel Door Institute's recommended erection instructions for steel frames SDI A250.11 and NAAMM/HMMA 840.
- B. DHI – Door and Hardware Institute – Door Security + Safety Professionals – Installation Guide for Doors and Hardware
- C. Fire Doors and Frames: Install in accordance with SDI A 250.11 and NFPA 80.
 - 1. To ensure compliance with Positive Pressure criteria as required by UBC7-2, UL10C, NFPA5000 and all applicable Local, State and National Code Jurisdictions, all Doors and Frames should be checked for accurate installation per Manufacturers installation instructions to provide proper fire and Smoke Gasketing as tested and listed.
 - 2. Fit hollow-metal doors accurately in frames, within clearances specified in SDI A 250.11 and SDI 100. Install fire rated doors with clearances specified in NFPA 80.
- D. Comply with provisions of SDI-105, "Recommended Erection Instructions for Steel Door Frames," unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
 - 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.

2. Drywall series frames are designed for installation in interior applications after construction of wood or metal stud and drywall applications. Drywall series frames are provided with adjustable jamb lock anchors for secure installation. Install frames per manufacturers' installation instructions. Adjust anchors and secure sill and baseboard anchors as provided.
- E. Remove temporary steel spreaders prior to installation of frames.
- F. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete, remove temporary wood spreaders.
 1. Field splice only at approved locations indicated on the shop drawings.
 2. Weld, grind, and finish as required to conceal evidence of splicing on exposed faces.
- G. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.
- H. Apply hardware in accordance with hardware manufacturers' instructions and Section 087100 of these Specifications. Install hardware with only factory-provided fasteners. Install silencers. Adjust door installation to provide 1/8" at head and 1/8" at strike and hinge jamb with door undercut to meet fire ratings and floor conditions to achieve maximum operational effectiveness and appearance.

3.3 FIELD QUALITY CONTROL

- A. Fire-Rated Door Assembly Testing:
 1. Upon completion of the installation, test each fire door assembly to confirm proper operation of its closing device and verify that it meets all criteria of a fire door assembly per NFPA 80.
 2. Perform inspections by individuals with documented knowledge and understanding of the operation components of the type of door being tested per NFPA 80 and NFPA 101.
 3. Provide a written record to the Owner with copies available to the Authorities Having Jurisdiction (AHJ).
 4. Record shall list the fire door assembly and include the door number with an itemized list of hardware set components for each door opening and location in the facility.

3.4 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.
- B. Clean and restore soiled surfaces. Remove scraps and debris and leave site in a clean condition.
- C. Prime Coat Touch-Up: Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible air-drying primer.
- D. Properly clean and apply paint to doors and frames in accordance with HMMA-840 TN01 and ANSI A250.8 appendix B along with Manufactures recommended surface preparation for painting.

3.5 PROTECTION

- A. Protect installed products and finished surfaces from damage during construction.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Interior Solid-core doors with wood-veneer and medium-density overlay, faces.
 2. Louvers for flush wood doors.
- B. Related Sections include the following:
1. Division 8 Section "Custom Steel Doors and Frames" for HM frames.

1.2 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
1. Indicate dimensions and locations of mortises and holes for hardware.
 2. Indicate dimensions and locations of cutouts.
 3. Indicate requirements for veneer matching.
 4. Indicate fire ratings for fire doors.
 5. Identify each door to correspond to Door Schedule shown on drawings.
- C. Samples for Verification:
1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required.
 2. Louver blade and frame sections, 6 inches long, for each material and finish specified.
- D. W.I. Certificates: Furnish a W.I. Certificate of Compliance prior to delivery of doors certifying that doors fully meet all the requirements of the W.I. grade or grades specified herein.
- E. References: NWWDA I.S.6-A and W.I. Section 12 – Doors, Premium Grade.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with WI's "Manual of Millwork."
1. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.

2. Provide WI-Certified Compliance Certificate for installation.

- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL10C and NFPA 252.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flush Wood Doors:
 - a. DoorMerica Products (basis of design)

- b. Algoma Hardwoods Inc.
- c. Haley Brothers, Inc.
- d. Vancouver Door Company, Inc.
- e. Weyerhaeuser Company

2. Metal Louvers for Doors:

- a. Air Louvers, Inc.
- b. Anemostat Door Products.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

- 1. Grade: Premium, with Grade AA faces.
- 2. Species and Cut: Maple or Birch, plain sliced.
- 3. Match between Veneer Leaves: Slip match.
- 4. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 5. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- 6. Transom Match: Continuous match.
- 7. Stiles: Same species as faces.

B. Doors for Opaque Finish:

- 1. Grade: Premium.
- 2. Faces for Interior Doors: Medium-density overlay.
- 3. Apply medium-density overlay to standard thickness, closed-grain, hardwood face veneers.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

- 1. Particleboard: ANSI A208.1, Grade LD-2.
- 2. Provide doors with either glued-block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

- 1. Core: Particleboard.
- 2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

- 1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.4 LOUVERS

A. Metal Louvers:

1. Blade Type: Vision-proof, inverted V or Vision-proof, inverted Y.
2. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
3. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Louvers: Factory install louvers in prepared openings.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Division 9 Section "Painting."

B. Doors for Transparent Finish: Shop seal faces and edge of doors, including cutouts, with stain (if required), other required pretreatments, and first coat of finish as specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to UL10C and NFPA 252.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
 - a. Comply with UL10C and NFPA 252 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Field-Finished Doors: Refer to the following for finishing requirements:
 - 1. Division 9 Section "Painting."

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

END OF SECTION 08 14 16

SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wall access doors and frames.
 - 2. Fire-rated wall access doors and frames.
 - 3. Ceiling access doors and frames.
 - 4. Fire-rated ceiling access doors and frames.
- B. Related Sections include the following:
 - 1. Division 8 Section "Door Hardware" for mortise or rim cylinder locks and master keying.

1.3 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.
- C. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 or UL 10B for vertical access doors.
 - 2. ASTM E 119 or UBC Standard 7.1 or UL 263 for horizontal access doors and frames.

- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Access Doors:
 - a. Bilco, Inc. (Floor Access)
 - b. Cesco Products. (Ceiling & Wall Access)
 - c. Dur-red Products. (Floor Access)
 - d. J. L. Industries, Inc. (Ceiling & Wall Access)
 - e. Karp Associates, Inc. (Ceiling & Wall Access)
 - f. Larsen's Manufacturing Company. (Ceiling & Wall Access)

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.
- C. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), with Class C coating and phosphate treatment to prepare surface for painting; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M for uncoated base metal.
- E. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

- F. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480/A 480M.
- G. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- H. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- I. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- J. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness.
- K. Plaster Bead: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.

2.4 ACCESS DOORS AND FRAMES

- A. Flush, Insulated, Fire-Rated Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.
 - 1. Locations: Ceramic-tile, wall and ceiling surfaces.
 - 2. Fire-Resistance Rating: Three-fourths or One hour, see plans.
 - 3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
 - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
 - 5. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
 - 6. Hinges: Continuous piano hinge.
 - 7. Automatic Closer: Spring type.
 - 8. Lock: Key-operated cylinder lock with interior release.
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Ceramic-tile, wall and ceiling surfaces.
2. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch thick sheet metal with 1-inch wide, surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver operated cam latch.
6. Lock: Key-operated cylinder lock with interior release lever.

2.5 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
 2. For trimless frames with drywall bead for installation in gypsum board assembly and gypsum veneer plaster, provide edge trim for gypsum board securely attached to perimeter of frames.
 3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 4. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms and locks: Furnish number required to hold doors in flush, smooth plane when closed.
 1. Cylinder lock:
 - a. Shall be full size interchangeable core (FSIC), capable of keying to the site's master key. Consult Door hardware specification.
 - b. Furnish with construction core upon delivery to the owner.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.
 3. For doors with latches released by and locks operated by mortise cylinders, prepare access doors for cylinders specified in Division 8 Section "Door Hardware."

- F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.7 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Polish: No. 4 finish.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

END OF SECTION 08 31 00

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SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of aluminum-framed windows:
 - 1. All exterior Architectural Performance Class (AW) windows furnished and installed as shown on drawings, specified in this section and designated in AAMA/WDMA/CSA 101/I.S.2/A440-2011 North American Fenestration Standard (NAFS-2011).
 - 2. All labor, materials, tools, equipment and services needed to furnish and install AW Class windows.
 - 3. Components furnished with installed windows.
 - 4. Installation accessories furnished and installed.
- B. Related Sections include the following:
 - 1. Division 8 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.3 DEFINITIONS

- A. AW: Architectural.
- B. C: Commercial.
- C. HC: Heavy Commercial.
- D. Performance grade number, included as part of the AAMA/NWWDA product designation code, is actual design pressure in pounds force per square foot used to determine structural test pressure and water test pressure.
- E. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.
- F. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
 - 1. Size: As indicated on Drawings.
- B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.
 - 1. Performance Class: HC/AW 50 (minimum for all windows)
 - 2. Performance Grade: Minimum for performance class indicated.
 - 3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on the following:
 - a. Testing performed according to AAMA/NWWDA 101/I.S.2, Uniform Load Deflection Test.
 - 4. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
 - 5. Basic Wind Speed: As indicated in miles per hour at 33 feet above grade. Determine wind loads and resulting design pressures applicable to Project according to the following, based on mean roof heights above grade as indicated on Drawings:
 - 6. Design Pressure: 25 lbf/sq. ft.
- C. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
 - 1. Maximum Rate: 0.3 cfm/sq. ft. of area at an inward test pressure of 1.57 lbf/sq. ft..
- D. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
 - 1. Test Pressure: 15 percent of positive design pressure, but not less than 2.86 lbf/sq. ft. or more than 12 lbf/sq. ft..
- E. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- F. Awning and Projected Windows: Comply with AAMA/NWWDA 101/I.S.2 for the following tests:

1. Sash Torsion Test.
2. Torsion Test.
3. Horizontal Concentrated Load Test on Latch Rail.
4. Vertical Concentrated Load Test on Latch Rail.
5. Torsion Load Test on Intermediate Frame Rails.
6. Vertical Concentrated Load Test on Intermediate Frame Rails.
7. Balance Arm Load Test.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.
- B. Shop Drawings: Include plans, 1/4" scale wall elevations, typical unit elevations at 3/4" scale, full size detail sections of every typical composite member, details, hardware, attachments to other Work, operational clearances. Include glazing details.
- C. Samples for Verification: For aluminum window components required, prepared on Samples of size indicated below.
 1. Main Framing Member: 12-inch- long, full-size sections of extrusions with factory-applied color finish.
 2. Hardware: Full-size units with factory-applied finish.
 3. Weather Stripping: 12-inch- long sections.
 4. Architect reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.
- D. Qualification Data: For Installer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of down-sized test units will not be accepted.
- F. Maintenance Data: For operable window sash, operating hardware, weather stripping, window system operators and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA-certified aluminum windows with an attached label.
- F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY *(Project Close-Out Item)*

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Failure to meet performance requirements.
 - 2. Structural failures including excessive deflection.
 - 3. Water leakage, air infiltration, or condensation.
 - 4. Faulty operation of movable sash and hardware.
 - 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 6. Insulating glass failure.
- B. Warranty Period: Three years from date of Substantial Completion.
- C. Warranty Period for Metal Finishes: 10 years from date of Substantial Completion.
- D. Warranty Period for Glass: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. All Window Types, Unless Otherwise Noted:
 - a. Wausau Corporation
 - 1) Model: 2250i Invent Retro XLT Window, Fixed, Awning, and Hopper with extended thermal separation.
 - 2) Glazing: dual
 - 3) Finish: Anodized clear
 - 4) Operator (at accessible windows):
 - a) Dual-arm Roto-Operator, 11 inch, – 5 lb. maximum operating force, (Wasau part number 100590)
 - b) with Roto Handle (part number 100643)
 - c) Track for Dual Arm Roto (part number 100605)
 - 5) Latch (at accessible windows): Linear operation latch - 5 lb. maximum operating force.
 - 6) Opening Restrictor, to prevent the leading edge of operable windows from projecting more than 4" horizontally, Wasau part number 100203.
 - b. Or approved equal

2.2 MATERIALS, GENERAL

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.062-inch thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.
1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide

sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.
- E. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.
 - 1. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C 864.
- F. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.
- G. Replaceable Weather Seals: Comply with AAMA 701/702.
- H. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.3 GLAZING

- A. Glass and Glazing Materials: Refer to Division 8 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.
- B. Glass: Clear, insulating-glass units complying with Division 8 Section "Glazing."
- C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal. Manufacturer's standard factory-glazing system as indicated in Division 8 Section "Glazing."
- D. Dual-Action Windows: Provide pivoting unit for double glazing, constructed of one sheet of glass in a removable sash for access to interior of unit, installed with airtight gaskets.

2.4 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum or nonmagnetic stainless steel.

- B. Counterbalancing Mechanism: Comply with AAMA 902.
- C. Sill Cap/Track: Extruded-aluminum with natural anodized finish track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
- D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
- E. Roller Assemblies: Low-friction design.
- F. Push-Bar Operators: Provide telescoping-type, push-bar operator designed to open and close ventilators with fixed screens.
- G. Gear-Type Rotary Operators: Comply with AAMA 901 when tested according to ASTM E 405, Method A.
 - 1. Operation Function: All ventilators move simultaneously and securely close at both jambs without using additional manually controlled locking devices.
- H. Four- or Six-Bar Friction Hinges: Comply with AAMA 904.
 - 1. Locking mechanism and handles for manual operation.
 - 2. Friction Shoes: Provide friction shoes of nylon or other nonabrasive, nonstaining, noncorrosive, durable material.
- I. Limit Devices: Provide limit devices designed to restrict sash or ventilator opening.
 - 1. Safety Devices: Limit clear opening to 6 inches for ventilation; with custodial key release.
- J. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than 60 inches above floor; 1 pole operator and pole hanger per room that has operable windows more than 72 inches above floor.
- K. Projected Windows: Provide the following operating hardware:
 - 1. Window-Operating System at accessible project-out windows: Wasau "Dual Arm Roto-Operator", designed to unlatch, open, and close operable sash with one movement, capable of operation with a closed fist and less than 5 pounds of force.
 - 2. Hinges: Concealed four- or six-bar friction hinges located on each jamb near top rail; two per ventilator.
 - 3. Lock: Combination lever handle and cam-action lock with concealed pawl and keeper; one (two if units over 42 inches wide or high) per ventilator.
 - 4. Lock: Key-operated custodial lock with removable handle.
 - 5. Limit Device: Concealed friction adjuster, adjustable stay bar or support arms with adjustable, limited, hold-open limit device; located on jamb of each ventilator.

2.5 FABRICATION

- A. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/NWWDA 101/I.S.2 performance requirements for the

following window type and performance class. Include a complete system for assembling components and anchoring windows.

1. All Window Types: HC and AW (HC/AW 50 Minimum).
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
 1. Horizontal-Sliding Windows: Provide operable sash with a double row of sliding weather stripping in horizontal rails and single- or double-row weather stripping in meeting or jamb stiles, as required to meet specified performance requirements. Provide compression-type weather stripping at perimeter of each movable panel where sliding-type weather stripping is not appropriate.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
- F. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- G. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide subframes capable of withstanding design loads of window units.
- H. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/NWWDA 101/I.S.2.
- I. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.6 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Clear Anodized Finish: AA-MA 611-98 Class I (Minimum thickness of 0.7 mils), etched, medium matte colored anodic coating natural aluminum coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances and other conditions affecting performance of work.
 - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction. All jambs and mullions shall have self adhered weather resistive barrier applied over wood prior to installation of window. All manufacturer's leg extenders or other accessories shall be applied over window sealant/tape, then exterior wood/aluminum trim shall be installed.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.

3.3 FIELD QUALITY CONTROL

- A. Remove and replace windows where inspection results indicate that they do not comply with specified requirements.

3.4 ADJUSTING

- A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 51 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:

- 1. Mechanical door hardware for:

- a. Swinging doors.

- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
 - 6. Installation.
 - 7. Rough hardware.
 - 8. Conduit, junction boxes & wiring.
 - 9. Folding partitions, except cylinders where detailed.
 - 10. Sliding aluminum doors, except cylinders where detailed.
 - 11. Access doors and panels, except cylinders where detailed.

- C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 3. Division 26 sections for connections to electrical power system and for low-voltage wiring.

1.3 REFERENCES

- A. UL - Underwriters Laboratories

UL 10B - Fire Test of Door Assemblies

- 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware

- B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- C. California Code of Regulations
 1. Title 24: California Building Standards Code

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.
 - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
 - c. Type, style, function, size, and finish of each hardware item.
 - d. Name and manufacturer of each item.
 - e. Fastenings and other pertinent information.
 - f. Location of each hardware set cross-referenced to indications on Drawings.
 - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - h. Mounting locations for hardware.
 - i. Door and frame sizes and materials.
 - j. Name and phone number for local manufacturer's representative for each product.
4. Key Schedule:
 - a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
 - b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.

- c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
 - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.
- C. Informational Submittals:
- 1. Qualification Data: For Supplier and Installer.
 - 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - 3. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
- 1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Final approved hardware schedule, edited to reflect conditions as-installed.
 - e. Final keying schedule
 - f. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
- 1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
 - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- G. Means of Egress Doors: Latches do not require more than 5 lbs (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs (22.2 N).
 2. Maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs (22.2 N) applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbs (22.2 N) applied parallel to door at latch.
 - c. Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 lbs (66.7N).
 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
 4. Adjust closer so that the time required to move the door from the 90 degree position to 12 degrees from the latch is 5 seconds minimum.
- I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Review sequence of operation for each type of electrified door hardware.

4. Review required testing, inspecting, and certifying procedures.

J. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed.
Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 1. Promptly replace products damaged during shipping.
 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - c. Locksets:
 - 1) Mechanical: 3 years.
 - d. Continuous Hinges: 10 years
 - e. Key Blanks: Lifetime
 - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

- A. Maintenance Tools:
 - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 California Building Code, Section 11B-404.2.7.
 - 1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
 - 1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
 - 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.
- C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 - 1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leaves or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

- D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.
- E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.
 - 1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
 - 2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.
 - 1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
 - 2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.
- G. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.
- H. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- I. Pairs of doors with independently-activated hardware both leaves: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.
- J. Door and door hardware encroachment: Doors, when fully open, shall not reduce the required width by more than 7 inches. Doors in any position shall not reduce the required width by more than one-half. 2022 California Building Code, Section 1005.7.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturer" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
- 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB series
- 2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series

B. Requirements:

- 1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.4 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND Series
2. Acceptable Manufacturers and Products: No substitutions.

B. Requirements:

1. Provide cylindrical locks conforming to the following standards and requirements:
 - a. ANSI/BHMA A156.2 Series 4000, Grade 1.
 - b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Cycle life - tested to minimum 10 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.

6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
 - a. Lever Design: As scheduled.

2.5 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99 series
2. Acceptable Manufacturers and Products: No substitutions

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

- a. Lever Style: Match lever style of locksets.

11. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

- a. "AX" feature: touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.

12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

2.6 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: No substitutions

B. Requirements:

1. Provide permanent, interchangeable core cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.7 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer or Owner according to the following key system.
 - a. Master Keying system as directed by the Owner.
 - b. Schlage "E" keyway (Verify).
 - c. Permanent cores to be "111111" BITTED.
2. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
4. Identification:
 - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
 - b. Identification stamping provisions must be approved by the Architect and Owner.

- c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
- d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
- e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

- a. Change (Day) Keys: 3 per cylinder/core.
- b. Permanent Control Keys: 3.
- c. Master Keys: 6.

2.8 DOOR CLOSERS

A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: LCN 4040XP series.
- 2. Acceptable Manufacturers and Products: No substitutions.

B. Requirements:

- 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
- 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
- 3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
- 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
- 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
- 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
- 7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
- 8. Pressure Relief Valve (PRV) Technology: Not permitted.
- 9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
- 10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 12 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.10 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.11 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.12 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Pemko

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.13 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Trimco
2. Acceptable Manufacturers: Ives

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.14 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Overhead Stops and Holders: BHMA 630 (US32D)
4. Door Closers: Powder Coat to Match
5. Wall Stops: BHMA 630 (US32D)
6. Weatherstripping: Clear Anodized Aluminum
7. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as indicated in keying section.

- I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- O. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. Hardware Sets:

HW SET: 01

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-99-NL-OP-110MD-499F	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	ANTI-VANDAL TRIM	1097HA	630	TRM
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1261/1263/1265/1267 (AS REQ'D) x 1268 ANCHOR	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER & STRIKE.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

HW SET: 02

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-99-NL-OP-110MD-499F	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	ANTI-VANDAL TRIM	1097HA	630	TRM
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER & STRIKE.

HW SET: 03

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL CORRIDOR LOCK	ND97TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1261/1263/1265/1267 (AS REQ'D) x 1268 ANCHOR	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER & STRIKE.

HW SET: 04

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	VANDL CORRIDOR LOCK	ND97TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	WALL STOP	1270CV	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW SET: 05

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	FLOOR STOP/HOLDER	1261/1263/1265/1267 (AS REQ'D) x 1268 ANCHOR	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL FLOOR STOP/HOLDER WITHIN 4" OF ADJACENT WALL TO PROTECT BACK OF DOOR.
INSTALL SEAL BEFORE CLOSER.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

HW SET: 06

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595 SPEC	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

INSTALL SEAL BEFORE CLOSER.

HW SET: 07

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STAFF RESTRM PRIVACY	LV9456 w/ XL13-439 II	626	SCH
1	EA	CUT KEY	35-251 EMERGENCY KEY	468	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	MOP PLATE	KM050 4" X 1" LDW B4E CS	630	TRM
1	EA	WALL STOP	1270CV	626	TRM
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW SET: 08

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER

HW SET: 09

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	EA	MOP PLATE	KM050 4" X 1" LDW B4E CS	630	TRM
1	EA	WALL STOP	1270CV	626	TRM
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

HW SET: 10

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	OH STOP & HOLDER	90H	630	GLY
1	EA	KICK PLATE	K0050 12" X 2" LDW B4E CS	630	TRM
1	SET	DOOR SEAL	328AA-S (HEAD & JAMBS)	AA	ZER

HW SET: 11

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	VANDL CLASSROOM SECURITY LOCK	ND98TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH

End of Section

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 08 81 00 – GLASS GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
- B. Related Sections include the following:
 - 1. Division 8 Section "Windows."
 - 2. Division 8 Section "Hollow Metal Doors".

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or

gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300. according to the following requirements.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- square Samples for glass.
 - 1. Each color of tinted float glass.
 - 2. Coated vision glass.
 - 3. Insulating glass for each designation indicated.
 - 4. For each color (except black) of exposed glazing sealant indicated.
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- D. Qualification Data: For installers.
- E. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- F. Product Test Reports: For each of the following types of glazing products:
 - 1. Tinted float glass.
 - 2. Coated float glass.
 - 3. Insulating glass.
 - 4. Glazing sealants.
 - 5. Glazing gaskets.
- G. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
 - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- E. Safety Glazing Products:
 - 1. Comply with testing requirements in CPSC 16 CFR Part 1201.
 - 2. Identify each pane of safety glazing with a manufacturer's designation specifying who applied the designation, the manufacturer or installer, and the safety glazing standard with which it complies per 2022 CBC Section 2406.3. Designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed, or of a type that once applied, cannot be removed without being destroyed.
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
 - 1. Insulating Glass Certification Council.
 - 2. Associated Laboratories, Inc.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.9 WARRANTY (Project Close-Out Item)

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- 1. Products: Subject to compliance with requirements, provide one of the products specified, or preapproved equal.
- 2. Manufacturers: One of the following for each glass type:
 - 1) Viracon, Inc.
 - 2) Vitro Architectural Glass
 - 3) Andersen Windows (for total unit performance).

2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
 - 1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 4. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
 2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 3. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.
 - b. Polyisobutylene and polysulfide.
 - c. Polyisobutylene and silicone.
 - d. Polyisobutylene and hot-melt butyl.
 4. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with mill or clear anodic finish or Galvanized steel.
 - b. Spacer bar to be bronze color where visible.
 - c. Desiccant: Molecular sieve or silica gel, or blend of both.
 - d. Corner Construction: Manufacturer's standard corner construction.

2.3 GLASS AND GLAZING TYPES

- A. Type A: 1 inch Insulated Glass with 1/2 inch air space – Low E
Design requirements: Overall U-factor 0.3, Overall SHGC 0.2, Overall VT 0.5
1. Exterior Sheet: 1/4 inch
 2. Interior sheet: 1/4 inch
- B. Type B: 1 inch Tempered Insulated Glass with 1/2 inch air space – Low E (Safety Glazing – see Quality Assurance section for identification requirements)
Design requirement: Overall U-factor 0.3, Overall SHGC 0.2, Overall VT 0.5
1. Exterior Sheet: 1/4 inch tempered
 2. Interior sheet: 1/4 inch tempered

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. One Part Silicone-Rubber Glazing Sealant (SR-GS): Elastomeric silicone sealant complying with FS TT-S-001543, Class A, non-sag. Provide acid type recommended by manufacturer where only nonporous bond surfaces are contacted; provide non acid type recommended by manufacturer where one or more porous bond surfaces are contacted.
- C. One Part Polysulfide Glazing Sealant (1Ps-GS): Polysulfide elastomeric sealant complying with FS TT-S-00230, Class A, Type II; Compounded specifically for exterior exposed glazing.
- D. One Part Acrylic Glazing Sealant (1Ac-GS): Thermo-plastic acrylic terpolymer, complying with FS TT-S-00230, Class B, Type II: solids of 95% acrylic.
- E. Preformed Butyl Rubber Glazing Sealant (PBuR-GS): Compound of polymerized butyl rubber and inert fillers, with or without polyisobutylene modification, solvent-based, 95% solids, formed and coiled on release paler; tack free in 24 hours, paintable, nonstaining; plain, preshimmed or reinforced as required for proper installation and setting of glass.
- F. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 GLAZING GASKETS

- A. Vinyl Foam Glazing Tape (VF-GT): Closed cell, flexible, self-adhesive, non-extruding, polyvinyl chloride foam tape; recommended by manufacturer for exterior, exposed, watertight installation of glass, with only nominal pressure in the glazing channel; comply with ASTM D 1667.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant, where indicated.

- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 SEALANT GLAZING

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 81 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 08 91 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed, extruded-aluminum louvers.
 - 2. Fixed, formed-metal louvers.
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 8 Section "Custom Steel Doors and Frames" for louvers in hollow-metal doors and frames.
 - 3. Division 8 Section "Flush Wood Doors" for louvers in wood doors.
 - 4. Division 9 Section "Painting (Professional Line Products)" for field painting louvers.
 - 5. Division 23 Section "HVAC Instrumentation and Controls" for electric, electronic, and pneumatic control of adjustable metal louvers.
 - 6. Division 23 Sections for louvers that are a part of mechanical equipment.
 - 7. Division 26 Sections for electrical power connections for motor-operated adjustable metal louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other

detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals and installation instruction for required products, including finishes.
- B. Shop Drawings: For louvers and accessories. Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing. Indicate material finishes, fasteners, joinery and other information to determine compliance with specification requirements.
- C. Samples for Verification: For each type of metal finish required.
- D. Finish Samples: Submit 6" square samples of each required finish. Prepare samples on metal of the same gage and alloy to be used in the work. Where normal color and texture variations are to be expected, include 2 or more units in each sample showing limits of such variation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain all louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures except otherwise indicated

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Louvers:
 - a. Airline Products Co.
 - b. Airolite Company (The).
 - c. Greenheck.
 - d. H.H. Robertson Co.
 - e. Ruskin Company; Tomkins PLC.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- E. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are incompatible with joined materials. Fasteners for exterior applications may be hot-dip galvanized, stainless steel or aluminum.
1. Use types and sizes, gauges and lengths, to suit unit installation conditions.
 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Coordinate field measurements and shop drawings with fabrications and assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing to produce uniform appearance.

- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: **[Channel] [Exterior flange]**, unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semirecessed mullions at corners, unless otherwise indicated.
- G. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver (FEAL-1):
 - 1. Louver Depth: Size and depth as indicated.
 - 2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch for blades and 0.080 inch for frames.
 - 3. Mullion Type: Exposed.
 - 4. Performance Requirements:
 - a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Point of Beginning Water Penetration: Not less than 950 fpm.
 - c. Air Performance: Not more than 0.15-inch wg static pressure drop at 950-fpm free-area velocity.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 FIXED, FORMED-METAL LOUVERS

- A. Horizontal, Drainable-Blade Louver (FFML-1):
 - 1. Louver Depth: 4 inches, unless otherwise indicated.

2. Frame and Blade Material and Nominal Thickness: Galvanized steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.0635 inch, unless otherwise indicated.
3. Louver Blade Angle: 30 degrees.
4. Formed Metal Blades: No. 666
5. Mullion Type: Exposed.
6. Performance Requirements:
 - a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Point of Beginning Water Penetration: Not less than 960 fpm.
 - c. Air Performance: Not more than 0.15-inch wg static pressure drop at 960-fpm free-area velocity.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.6 LOUVER SCREENS

- A. General: Provide removable screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screen Location for Adjustable Louvers: Interior face, unless otherwise indicated.
 3. Screening Type: Bird screening where indicated; insect screening where indicated.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening (where shown): Aluminum, 1/2-inch- square mesh, 0.063-inch wire.
 2. Insect Screening (where shown): Aluminum, 18-by-16 mesh, 0.012-inch wire.
- E. Louver Screening for Galvanized Steel Louvers:
 1. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire.
 2. Insect Screening: Galvanized steel, 18-by-14 mesh, 0.011-inch wire.

2.7 BLANK-OFF PANELS

- A. Uninsulated, Blank-off Panels:
 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness, unless otherwise indicated.
 2. Galvanized steel sheet for galvanized steel louvers, not less than 0.052-inch nominal thickness, unless otherwise indicated.

3. Panel Finish: Same finish applied to louvers, unless otherwise indicated.
4. Attach blank-off panels to back of louver frames with stainless-steel, sheet metal screws.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 1. Color: As selected by Architect from the full range of industry colors and color densities.
- D. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).
 1. Organic Coating: Air-dried primer of not less than 2-mil dry film thickness.
- E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils, medium gloss.
 2. Color: As selected by Architect from manufacturer's full range.
- F. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

2.10 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
- B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
- C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- D. Powder-Coated Finish: Prepare, treat, and coat galvanized metal louvers to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare louvers by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - 2. Treat prepared louvers with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
 - 4. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured. Provide reveals and openings for sealants and joint fillers, as indicated.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 00

(3/06)

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
 - 2. Vinyl tackboard wall paneling.
- B. Related Sections include the following:
 - 1. Division 5 Section "Steel Studs and Joists" for load-bearing and non-load-bearing steel framing.
 - 2. Division 6 Section "Rough Carpentry" for wood framing and furring, and gypsum sheathing applied over wood framing.
 - 3. Division 7 Section "Thermal Insulation" for insulation and vapor retarders installed in gypsum board assemblies.
 - 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for framing, gypsum panels, and other components of shaft wall assemblies.
 - 5. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Single Source: Obtain gypsum board products from a single manufacturer, or from manufacturer's recommended by the prime manufacturer of gypsum board.
- B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated

according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." and GA-600, "Fire Resistance Design Manual".
- C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
- D. Gypsum Board Terminology Standard: GA-505.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends and surfaces. Protect metal corner beads and trims from being bent or damaged.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
 1. Cold Weather Protection: When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, comfortable building working temperatures of not less than 55 degrees F for a minimum of 48 hours prior to, during and following application of gypsum board and joint treatment or bonding of adhesives.
 2. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of the following:
 1. Gypsum Board and Related Products:

- a. American Gypsum Co.
 - b. Domtar Gypsum
 - c. Flintkote Products, Genstar Building Materials Co.
 - d. G-P Gypsum Corp.
 - e. Gold Bond Building Products Div., National Gypsum Company.
 - f. United States Gypsum Co.
 - g. Pabco
2. Direct Suspension Systems:
- a. Chicago Metallic Corp.
 - b. Donn Corporation
 - c. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
1. Regular Type:
 - a. Thickness: 5/8 inch, unless otherwise indicated.
 - b. Long Edges: Tapered.
 - c. Location: As indicated.
 2. Type X:
 - a. Thickness: 5/8 inch, unless otherwise indicated.
 - b. Long Edges: Tapered.
 - c. Location: Where required for fire-resistance-rated assembly.
- C. Gypsum Backing Wallboard for Multi-Layer Application: ASTM C 442.
1. Core: 5/8 inch, regular type and 5/8 inch, Type X for rated assemblies.
 2. Long Edges: Manufacturer's standard.
 3. Location: As indicated.
- D. Proprietary Abuse-Resistant Gypsum Wallboard: ASTM C 36, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. National Gypsum Company; Gold Bond Hi-Abuse Wallboard.
 - b. United States Gypsum Co.; SHEETROCK Brand Abuse-Resistant Gypsum Panels.
 2. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.
- E. Moisture and Mold Resistant Gypsum Backing Board: ASTM C 1396.

1. Core: 5/8 inch, regular type and 5/8 inch, Type X for fire rated assemblies.

2.3 BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Fiberboard Tack Base (for vinyl wall covering specified elsewhere): Fed. Spec. LLL-1-535.
 1. Products:
 - a. United States Gypsum Corp.
 2. Thickness: ½ inch thick. Primed and ironed.
 3. Flame Spread: 25
 4. Smoke Developed: 10
 5. ASTM E84: Meets or exceeds (Class A).
- C. Prefinished Vinyl Covered Tackboard Wall Paneling: ASTM E-84-87.
 1. Products:
 - a. Lamvin, Inc. 760. 806.6400
 - b. Chatfield Clark. 909.823.4297
 2. Thickness: ½ inch by 48 inches by full height
 3. Flame Spread: Class II – 75 or less.
 4. Trims: “L” angle, “H” bead, “J” bead and etc., as manufactured by panel manufacturer.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use where indicated.
 - e. Expansion (Control) Joint: Use where indicated.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.
- B. Exterior Trim: ASTM C 1047.
 1. Material: Hot-dip galvanized steel sheet or rolled zinc.
 2. Shapes:

- a. Cornerbead: Use at outside corners.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated.
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. MM Systems Corporation.
 - d. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified, unless otherwise indicated.
- D. High Impact Corner Guards:
 - 1. Koroseal Wall Protection Systems., G100 High Impact Corner Guard (2"x2" 90 degrees), .080 thickness extruded from chemical and stain resistant PVC with the addition of impact modifiers, embossed texture.
 - 2. Corner guards to be 48 inches high unless otherwise indicated.
 - 3. Color selection by Architect from manufacturer's full range of colors.
 - 4. Top and bottom caps of injection molded thermoplastic. Color to match corner guards.
 - 5. Corner Guards shall have continuous aluminum retainer.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.
3. Cementitious Backer Units: As recommended by manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Gypsum Board Nails and Screws: Comply with ASTM C-840.

D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

G. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

H. Gypsum Board Nails and Screws: ASTM C-840

I. Resilient Channels: USG RC-1.

- J. Concealed Acoustical Sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant for concealed applications per ASTM C 919.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
 - a. Use deep-leg deflection track where indicated.
 - b. Use proprietary deflection track where indicated.
 - c. Use proprietary firestop track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 4. Secure rod, flat and angle hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to steel deck tabs.
 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing with hangers used for support.
- D. For exterior soffits, install cross bracing and framing to resist wind uplift.
- E. Screw furring to wood framing.
- F. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.
- G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216. Comply with 2010 CBC Section 2508.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.

- M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.6 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
- C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- E. Tile Backing Panels:
 - 1. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at other locations indicated to receive water-resistant panels.
 3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.
- F. Fiberboard Tack Base: Install over gypsum backing board with adhesive with either nails or screws as required, with approximately 1/8 inch space at joints. Where installed over concrete or masonry substrate, nail with concrete nails to hold for adhesive.

3.7 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings. If not shown, install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.8 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated
 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.
 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
 5. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.

3.9 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching Architect approved mockup and free of starved spots or other evidence of thin application or of application patterns.

1. Spray Knock-Down Texture shall be applied to all gypsum board surfaces to be painted. Provide (3) different textured samples for review and approval by Architect on a 2'x2' gypsum board.

- B. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.10 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.

3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09 21 16

(9-2-08/jm)

SECTION 09 24 00 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Nonstructural steel framing and furring.
 - 2. Exterior portland cement plasterwork (stucco) on metal lath plaster bases.
- B. Related Sections include the following:
 - 1. Division 5 Section "Steel Studs and Joists" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
 - 2. Division 6 Section "Rough Carpentry" for wood framing and furring, sheathing, and water-resistant barriers included in portland cement plaster assemblies.
 - 3. Division 7 Section "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
 - 4. Division 7 Section "Joint Sealants" for acoustical sealants and sealants installed with exterior portland cement plaster (stucco).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.
- C. Samples for Verification: For each type of colored and textured finish coat indicated; 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For portland cement plaster assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Mockups: Before plastering, prepare mockups of at least 4 feet by 4 feet area by full thickness to demonstrate final aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each type of finish indicated and with materials, including lath and support systems, indicated for final work.
2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
3. Obtain Architect's acceptance of panel's visual quality before commencement of work.
4. Retain panel(s) during construction as a standard for judging completed work.
5. Remove panel(s) at completion and acceptance of work.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

D. Standards: Plastering shall be done in accordance with these specifications; the "Reference Specifications" of the California Lathing and Plastering Contractor's Association, Inc. (latest edition); The Metal Lath manufacturer's Association specifications, and Title 24, 2019 CBC, Chapter 25.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 NONSTRUCTURAL STEEL FRAMING MEMBERS, GENERAL

A. Manufacturers:

1. Chicago Metallic Corporation
2. Gold Bond Building Products Div., National Gypsum Co.
3. Milcor Division; Inryco, Inc.
4. United States Gypsum Co.
5. Western Metal Lath & Steel Framing Systems.

B. Components, General: Comply with ASTM C 1063. For steel sheet components not included in ASTM C 1063, comply with ASTM C 645 requirements for metal, unless otherwise indicated.

C. Cold-Rolled Channels: Base metal thickness of 0.0538 inch with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.3 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

1. Manufacturers:

- a. California Expanded Metal Products Company (CEMCO).
- b. Gold Bond Building Products Div., National Gypsum Co.
- c. Milcor Division; Inryco, Inc.
- d. United States Gypsum Co..
- e. Western Metal Lath & Steel Framing Systems.

2. Diamond-Mesh Lath: Self-furring.

- a. Weight: 3.4 lb/sq. yd.

3. 3/8-Inch Rib Lath:

- a. Weight: 3.4 lb/sq. yd.

B. Wire-Fabric Lath:

1. Manufacturers:

- a. Davis Wire Corporation.
- b. Jaenson Wire Company.
- c. Keystone Steel & Wire.

2. Woven-Wire Lath: ASTM C 1032; self-furring, with stiffener wire backing.

- a. 17 gage. x 1-1/2 inch galvanized.

- C. Paper Backing: FS UU-B-790, Type I Grade D, Style 2 vapor-permeable paper. Two layers, 30 minute and in accordance with 2010 CBC Section 2510.6.

2.4 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

- B. Zinc and Zinc-Coated (Galvanized) Accessories:

- 1. Manufacturers:
 - a. California Expanded Metal Products Company (CEMCO).
 - b. Fry Regelet Corporation
 - c. Gold Bond Building Products Div., National Gypsum Co.
 - d. Keene Corporation
 - e. Milcor Division; Inryco, inc.
 - f. United States Gypsum Co.
 - g. Western Metal Lath & Steel Framing Systems.
- 2. Foundation Weep Screed: Western No. 7 or No. 36. Fabricated from hot-dip galvanized steel sheet, ASTM A 653/A 653M, G60 zinc coating.
- 3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
- 4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
- 5. Cornerbeads: Western No. 1A. Fabricated from zinc or zinc-coated (galvanized) steel.
 - a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
 - b. Small nose cornerbead with perforated flanges; use on curved corners.
 - c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.
 - d. Allow full encasement of plaster.
- 6. Casing Beads: Western No. 66. Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
- 7. Control Joints: Keene XJ15-3. Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
- 8. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
- 9. Two-Piece Expansion Joints: Western No. 40. Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4-to-5/8-inch wide; with perforated flanges.
- 10. Soffit vent screeds: As indicated

2.5 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
 - 1. Products:
 - a. Dur-O-Fiber AR Glass; Dur-O-Wall
 - b. Harbourite; Fibermesh, Inc.
 - C. Bonding Compound: ASTM C 932.
 - D. Steel Drill Screws: Galvanized, for metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with wafer head that is suitable for application; in lengths required to achieve penetration through joined materials of not fewer than ¼ inch.
 - E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
 - 1. Nails: Galvanized furring nails, No. 12 gauge 3/8 inch head with 3/8 inch wad spacers for lath attachment. Minimum 1-1/4 inch penetration into structure.
 - 2. Ring Shank Hook Staples: No. 9 W & M gauge, ½ inch wide x 1-1/2" inches long "J" staple for soffit application only.
 - 3. Earthquake Staples: No. 16 gauge, galvanized, round or flattened wire, with chisel or divergent points, ¾ inch crown and 1-1/4 inch legs for soffit application only.
 - F. Wire Ties: 16 gage galvanized.
 - G. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - H. Isolation Strip at Exterior Walls:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.
 - I. Window and/or Door Flashing, provide either of the following:
 - 1. Kraft paper flashing conforming to F.S. UU-B-790A, Style 4, Grade A,B,C; 6 inch minimum width in the vertical wall plane.
 - 2. Self-adhered rubberize asphaltic membrane i.e. Vicor by Grace Manufacturing, 6 inch minimum width in the vertical wall plane.
- 2.6 PLASTER MATERIALS Retain second option in first paragraph below if sulfate resistance is required.
- A. Portland Cement: ASTM C 150, Type I or III.
 - 1. Color for Base Coats: Gray.

- B. Masonry Cement: ASTM C 91, Type N.
 - 1. Color for Base Coats: Gray.
- C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- D. Sand Aggregate: ASTM C 897.
 - 1. Color for Job-Mixed Finish Coats: In color matching Architect's sample.
- E. Ready-Mixed Integral Color Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
 - 1. Products:
 - a. LaHabra Stucco.
 - b. King Stucco Inc.
 - c. Superior Stucco Products
 - d. Western Stucco Products Inc.
 - 2. Color: As selected by Architect from manufacturer's full range.
- F. Additives: "PRF", Gibco Industries.

2.7 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
 - 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 2 lb of fiber/cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 - 1. Portland Cement Mixes:
 - a. Scratch Coat (3/8"): For cementitious material, mix 1 part portland cement, 3 oz. PRF (per 94 lbs Portland cement). Use 4 parts sand per part of cementitious material (sum of separate volumes of each component material).
 - b. Brown Coat (3/8"): For cementitious material, mix 1 part portland cement, 3 oz. PRF (per 94 lbs. Portland cement). Use 5 parts sand per part of cementitious material (sum of separate volumes of each component material).
- C. Factory-Prepared Finish-Coat Mixes (1/8"): For ready-mixed finish-coat plasters, comply with manufacturer's written instructions. Add water only.
 - 1. Finish coat shall be textured as noted on the Drawings or as selected by Architect.

- D. Mixing: Mechanically mix cementitious and aggregate material for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid-plaster bases that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
- C. Acoustical Sealant: Where required and indicated, seal joints between edges of plasterwork and abutting construction with acoustical sealant.
- D. Sealant: Seal around all window frames and transition to provide a "water tight" exterior finish.

3.4 INSTALLING NONSTRUCTURAL STEEL FRAMING, GENERAL

- A. General: Comply with requirements in ASTM C 1063 for applications indicated.
 - 1. Comply with ASTM C 754 for installation of items not addressed in ASTM C 1063.
- B. Install supplementary framing, blocking, and bracing at terminations in plaster assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement.

1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
2. Isolate partition framing and wall furring where it abuts structure, except at floor. At head of assemblies, install slip-type joints that avoid axial loading and that support assembly laterally.

- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.
- E. Soffits: Unless otherwise detailed on Drawings, install furred or suspended soffits to comply with requirements for ceiling installation; install framed soffits to comply with requirements for partition installation.

3.5 INSTALLING METAL LATH

- A. General: Install expanded metal lath or stucco netting where plaster base is required. Provide appropriate type, configuration and weight of material selected from materials indicated which comply with referenced lathing installation standards.
1. Comply with the requirements of ML/SFA "Specification for METAL Lathing and Furring" applicable to each installation condition indicated.
- B. Ceramic Tile Setting Beds:
1. Use diamond mesh lath, 3.4 lbs. per square yard, paper backed. Maximum variation in the backing surface shall not exceed 1/8" in 8 feet from the required plane.
- C. Exterior Sheathed Wall Surfaces; Steel Stud Construction: Install 2 layers 60 minute, Grade D paper, shingle style over sheathing with 3 inch edge laps and 6 inch end laps. Over building paper install self furring stucco netting. Provide wadding for sheet metal screw attachment to maintain 1/4 inch minimum spacing of netting from backing surface. Self furring stucco netting shall be installed to maintain 1/4 inch spacing of netting from backing surface in all conditions.

3.6 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
1. Install lath-type external-corner reinforcement at exterior locations.
 2. Install cornerbead at interior locations.
- C. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated in specific locations complying with following criteria and approved by Architect for visual effect as follows:
1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft..
 - b. Horizontal and other Nonvertical Surfaces: 100 sq. ft..

2. At distances between control joints of not greater than 18 feet o.c.
 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1. 10 feet maximum in both vertical and horizontal dimensions.
 4. Where control joints occur in surface of construction directly behind plaster.
 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
 6. Attach control joints to stucco mesh by wire tying at 24 inches on center.
- D. Drip Screeds: Install drip screed a minimum of 4 inches above grade, unless otherwise shown.
- E. Soffit Vent Screeds: Install soffit vent screed where shown sufficient to vent all concealed attics, joist spaces, etc.
- F. Window Flashing: Install window flashing material at window head, jambs and sill. Lap adjacent flashing material 6 inches minimum.

3.7 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
 2. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor.
 3. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 4. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Curing: Moisture cure Portland cement plaster base and finish coats to comply with ASTM C 926, including between coats and curing required by 2007 CBC, Table 2512.6.
- C. Bonding Compound: Apply on unit masonry and concrete plaster bases.
- D. Plaster Finish Coats: Apply to provide finish and texture to match Architect's sample.
- E. Sand smooth-troweled finishes lightly to remove trowel marks and arises.
- F. Apply fog coat over patches and adjacent areas where there is a transition in surface plane.
- H. Caulk or seal around all window frames and transitions to provide a "water tight" ext. finish.

3.8 CUTTING AND PATCHING

- A. Cut, patch, replace, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters,

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 24 00

(3/06)

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Glazed ceramic wall tile.
 - 2. Mosaic porcelain floor tile.
 - 3. Waterproof membrane for thin-set tile installations.
- B. Related Sections include the following:
 - 1. Division 1 Section "Selective Demolition" for removing existing finishes.
 - 2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.
- B. Ceramic tile flooring shall be stable, firm, and slip resistant, per CBC Section 11B-302.1.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

- C. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer. *(Project Close-Out Item)*
- D. Product Certificates: For each type of product, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Joint sealants.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS *(Project Close-Out Item)*

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Manufacturers:
 - 1. Daltile; Div. of Dal-Tile International Inc.
 - 2. American Olean; Div. of Dal-Tile International Corp.
 - 3. Or approved equal.
- B. Glazed Wall Tile at Restrooms: Flat tile as follows:
 - 1. Module Size: **4x4 inches.**
 - 2. Thickness: 5/16 inch.
 - 3. Face: Plain with cushion edges.
 - 4. Price Group: Color selection shall be made from price range of Price Groups 1 and 2.
 - 5. Colors:
 - a. Field : 0100 "White", Glossy
 - b. Accent 1: Color Wave Glass Moasic, "Winter Blues" CW27
 - c. Cove Base: "Suede Gray", glossy.
 - 6. Grout color: **Custom Building Products**
 - a. Wall – Field: **#544 Rolling Fog**
 - b. Wall – Base: **#19 Pewter**
 - 7. Insert special-purpose tile requirements here if required.
 - 8. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base for Portland Cement Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches.
 - b. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size 4-1/4 by 4-1/4 inches.
 - c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above.
 - d. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch unless otherwise indicated.
 - e. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.
 - f. Sizes for Trim Shapes: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.

C. Factory-Mounted Mosaic Porcelain Tile (Unglazed)

1. Manufacturers:
 - a. Daltile
 - 1) Keystones Groups 1 and 2
2. Face Size: 2" x 2".
3. Thickness: 1/4 inch.
4. Face: Plain with cushion edges.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: "Suede Grey Speckle"
7. Grout Color: Custom Building Products #19 Pewter.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Surface bullnose, module size, same as adjoining flat tile.
 - b. External Corners: Surface bullnose, module size same as adjoining flat tile.
 - c. Internal Corners: Field-buttet square corners.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. Liquid-Applied Elastomeric Waterproofing Membrane.
 1. Products:
 - a. Custom Building Products – RedGard Waterproofing and Crack Prevention Membrane.
 - b. Or approved equal.

2.5 SETTING AND GROUTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 1. Cleavage Membrane: Asphalt felt, ASTM D226/D226M, Type I (No. 15); or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
 2. Reinforcing Wire Fabric: Galvanized, self-furring welded-wire lath, 1-1/2 by 1-1/2 inches by 17 gauge diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
 3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 1. Manufacturers:
 - a. Bostik.
 - b. Custom Building Products.

- c. LATICRETE International Inc.
 - d. MAPEI Corporation.
- 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

- 1. Manufacturers:
 - a. Bostik.
 - b. Custom Building Products.
 - c. LATICRETE International Inc.
 - d. MAPEI Corporation.
- 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
- 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

- 1. Manufacturers: Custom Building products or approved equal.
- 2. Unsanded grout mixture for joints 1/8 inch and narrower.
- 3. Sanded grout mixture for joints more than 1/8 inch wide.

B. High-Performance Tile Grout: ANSI A118.7.

- 1. Manufacturers: Custom Building products or approved equal.
- 2. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
- 3. Unsanded grout mixture for joints 1/8 inch and narrower.
- 4. Sanded grout mixture for joints more than 1/8 inch wide.

C. Water-Cleanable Epoxy Grout: ANSI A118.3

- 1. Manufacturers: Custom Building products or approved equal.

2.7 MISCELLANEOUS MATERIALS

A. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

- 1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

- B. 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.
- C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 - 1. Products:
 - a. Bostik; CeramaSeal Grout Sealer.
 - b. Custom Building Products; Grout and Tile Sealer.
 - c. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 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 A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. 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.
 - 4. 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.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. 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.

3.3 INSTALLATION OF CLEAVAGE MEMBRANE AND LATH

- A. Membrane shall be lapped 6" vertically and 2" horizontally, and continuous behind expansion joints, if occurs.
- B. Lath shall be lapped a minimum of 2 inches at sides and end where sheets are joined. Wire must be stopped at expansion joints.
 - 1. Separate application of membrane and lath is recommended. Pan head type non-corrosive fasteners shall be used and be of sufficient length to penetrate into studs.

3.4 INSTALLATION OF PORTLAND CEMENT PLASTER BACKING

- A. Plaster scratch coat and leveling coat
 - 1. Shall be mixed of one part Portland cement, ½ part hydrated lime and four parts dry sand or five parts damp sand by volume: (ANSI A 108.1A-2008).
 - 2. Cure minimum of 24 hours before applying brown coat.
- B. Brown coat (mortar bed mix)
 - 1. Shall be mixed one part Portland cement, ½ part hydrated lime and five parts damp sand (ANSI A 108.1A2.1.1 2008). Cure time shall be 14 days or more. Climate conditions may require longer periods to reduce moisture content of plaster assembly.
 - 2. Brown coat shall be within ½ inch in 10 feet of the required plane, with a wood float finish, with no abrupt offsets in the finish greater than 1/16 inch in 12 inches.

3.5 INSTALLATION OF CERAMIC TILE

- 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.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain Mosaic Tile: 1/8 inch.
 - 2. Glazed Wall Tile: 1/16 inch.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. 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.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.6 INSTALLATION OF WATERPROOF MEMBRANES

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.7 INSTALLATION OF CRACK ISOLATION MEMBRANES

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.8 ADJUSTING AND CLEANING

- 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 ceramic 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.

3.9 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.10 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. TCNA F112 and ANSI A108.1C: Cement mortar bed (thickset) bonded to concrete.

- a. Ceramic Tile Type: Unglazed mosaic porcelain tile
- b. Bond Coat for Cured-Bed Method: Standard dry-set, Modified dry-set, Medium-bed, modified dry-set, or Improved modified dry-set mortar.
- c. Grout: High-performance unsanded Epoxy grout.

B. Interior Wall Installations, Masonry or Concrete:

- 1. TCNA W231/W241 and ANSI A108.1B Cement mortar bed (thickset).
 - a. Ceramic Tile Type: Glazed wall tile.
 - b. Bond Coat for Wet-Set Method: Standard dry-set, Modified dry-set, or Improved modified dry-set mortar.
 - c. Bond Coat for Cured-Bed Method: Standard dry-set, Modified dry-set, or Improved modified dry-set mortar.
 - d. Grout: High-performance unsanded grout.

END OF SECTION 093013

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for adjacent ceiling framing.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Coefficient
- D. CAC: Ceiling Attenuation Class

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For components with factory-applied color finishes.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- D. Qualification Data: For testing agency.

- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- F. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.
- G. Maintenance Data: Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances. Resubmit at closeout.

1.5 QUALITY ASSURANCE

- A. Comply with 2016 CBC Section 2506.2.1 and DSA IR 25-2.13.
- B. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- C. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Flame Spread: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages 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.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
- C. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING - APC-A

- A. Products: US Gypsum Radar #2311
- B. Color: White.
- C. LR: Not less than 0.82.
- D. NRC: Not less than 0.70.
- E. CAC: 35 - 40.
- F. Flame Spread: 0-25.
- G. Edge Detail: Square.
- H. Thickness: 3/4 inch.
- I. Size: 24 by 48 inches.
- J. Antimicrobial Treatment: BioBlock Mold/Mildew Protection.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated, or if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.
 - C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
 - D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
 - E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
 - F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
 - G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
 - H. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- 2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING APC-A, B, and C
- A. Products:
 - 1. Chicago Metallic Corporation; Series: 1200, Heavy Duty
 - a. Main Runner: 211-01
 - b. Cross Runner: 1228-01 (1226 for 2 x 2 Grid)
 - 2. Donn Corporation; Series: DX/DXL, Heavy Duty
 - a. Main Runner: DX24
 - b. Cross runner: DX216, DX316, DX416
 - 3. Armstrong World Industries; Series: 7300, Heavy Duty
 - a. Main Runner: 7300 (Non-fire-resistance), HD 8201 (Fire-resistance-rated)
 - b. Cross Runner: XL-7328, XL-7342 (Non-fire-resistance), XL 8200 series (Fire-resistance-rated).

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:

1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation.
3. Donn Corporation

B. Sheet-Metal or Plastic Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.7 ACOUSTICAL SEALANT

A. Products:

1. Acoustical Sealant for Exposed and Concealed Joints:

- a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

- a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
- b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
- c. Pecora Corp.; BA-98.
- d. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of four tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 6 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Unless unavoidable, do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. 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 a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels with pattern running in one direction.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. 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.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

(sfa-1/2020)

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wall base.
- B. Related Sections include the following:
 - 1. Division 9 Section "Carpeting"

1.3 SUBMITTALS

- A. Product Data: 2 copies of manufacturers technical data and installation instructions for each type of product indicated.
- B. Samples for Initial Selection: Actual sections for each type of product indicated, from manufactures full range of colors and patterns available.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Maintenance Data: Provide 2 copies each for each type of resilient products used to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Wherever possible, provide required resilient wall base and accessories produced by a single manufacturer.

1.5 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 65 deg F or more than 90 deg F .

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

- A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.

1. Armstrong World Industries, Inc.
 2. Burke Mercer Flooring Product
 3. Johnsonite
 4. Flexco (basis of design).
- B. Type (Material Requirement): Complying with FS SS-W-40; Type I rubber.
- C. Group (Manufacturing Method): Type I with matching end stops and factory interior and exterior corner units, and as follows:
- D. Style: Cove (with top-set toe) at all locations.
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches unless indicated otherwise.
- G. Lengths: Coils in manufacturer's standard length.
- H. Outside Corners: Pre-molded.
- I. Inside Corners: Pre-molded.
- J. Surface: Smooth.
- K. Color: "Umber" #078.

2.4 RESILIENT MOLDING ACCESSORY

- A. Description: Cap for cove carpet. Cap for cove resilient sheet floor covering. Carpet bar for tackless installations. Carpet edge for glue-down applications. Nosing for carpet. Nosing for resilient floor covering. Reducer strip for resilient floor covering. Joiner for tile and carpet, etc. Provide applicable molding to create flush transitions and finished edges.
1. Burke Mercer Flooring Products
 2. Johnsonite
 3. Roppe Corporation
- B. Material: Rubber.
- C. Profile and Dimensions: By Manufacturer.

2.5 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 manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 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.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. 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. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- D. Apply concrete slab primer, if required and recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.

- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Pre-molded Corners: Install pre-molded corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to stair accessory surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 - 2. Cover stair accessory products with un-dyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over stair accessories. Place plywood or hardboard panels over surfaces and under objects while they are being moved. Slide or roll objects over panels without moving panels.

3.6 PROJECT CLOSE OUT

- A. See individual headings in this section for exact requirements.

END OF SECTION 09 65 13

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 09 65 16 – RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
- B. Related Documents
 - 1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.
- C. Related Sections:
 - 1. Other Division 9 sections for floor finishes related to this section but not the work of this section.
 - 2. Division 3 Concrete; not the work of this section
 - 3. Division 6 Wood and Plastics; not the work of this section
 - 4. Division 7 Thermal and Moisture Protection; not the work of this section

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. ASTM F 1913 Standard Specification for Sheet Vinyl Floor Covering without Backing
 - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
 - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
 - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- B. Administrative Requirements
 - 1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manu-

- facturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
 - 2. Pre-installation Testing: Conduct pre-installation testing as follows: Perform test per ASTM F 710 and ASTM F 1869. See part 3.
 - 3. Mock-Up Size: 48 X 48" min.
 - 4. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 5. Incorporation: Mock-up may be incorporated into the final construction with Owner's approval.
- C. Sequencing and Scheduling
- 1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
 - 2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.04 SUBMITTALS

- A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.
- C. Submit Safety Data Sheets (SDS) available for adhesives, weld rod, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.
- D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- E. Closeout Submittals: Submit the following:
 - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - 2. Warranty: Warranty documents specified herein

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- B. Select an installer who is experienced and competent in the installation of Armstrong resilient sheet flooring [using heat-welded seams] [using Armstrong Flooring S-761 Seam Adhesive method] and the use of Armstrong Flooring subfloor preparation products.
 - 1. Engage installers certified as Armstrong Flooring Certified Installers
- C. Confirm installer's certification by requesting their credentials.
- D. Fire Performance Characteristics: Provide resilient vinyl sheet flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
 - 3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Division 1 Product Requirements Sections
- B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.07 PROJECT CONDITIONS

- A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 100°F (38°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to product installation recommendations for a complete guide on project conditions.

1.08 LIMITED WARRANTY

- A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- B. Limited Warranty Period: 10 years.
- C. The Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
- D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.09 EXTENDED SYSTEM LIMITED WARRANTY

- A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.
- B. Limited Warranty Period: 10 years on top of the Resilient Flooring Limited Warranty
- C. [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ flexible patching and smoothing compound] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 NP Prime Strong™ epoxy primer for non-porous substrates] [S-462 Seal Strong™ two-part moisture mitigation system]
- D. The installation of an Armstrong Flooring product along with the recommended Armstrong Flooring adhesive, as well as any one of the Strong System subfloor preparation products listed above, provides 10 additional years of limited warranty coverage. The Strong System limited warranty covers the installation integrity for the length of the flooring product warranty plus 10 years. To qualify for the Strong System Warranty, any subfloor preparation product needed for an installation must be an Armstrong Flooring product.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- E. For the System Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.
- F. When Armstrong Flooring Strong System subfloor preparation products are used with other manufacturers' floor coverings, adhesives, or other subfloor preparation products, Armstrong Flooring warrants our products to be free from manufacturing defects from the date of purchase through the limited warranty period of 20 years.

1.10 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from the same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Resilient sheet flooring, wall base, adhesives, and accessories:
 - 1. AHF Products, 3840 Hempland Road, Mountville, PA 17554,
www.armstrongflooring.com/commercial.
 - 2. Manufacturer must have a headquarters in the United States of America.

Specifier Note: Retain article below for proprietary method specification. Add product attributes, performance characteristics, material standards and descriptions as applicable. Use of such phrases as "or equal" or "or approved equal" or similar phrases may cause ambiguity in specifications. Such phrases require verification (procedural, legal, and regulatory) and assignment of responsibility for determining "or equal" products.

2.02 RESILIENT SHEET FLOORING MATERIALS

- A. Provide Homogeneous Sheet Flooring: [Medintone™ with Diamond 10® Technology] manufactured by AHF Products.
 - 1. Description: An unbacked, nonlayered, homogeneous sheet vinyl flooring. Protected by a diamond-infused UV-cured polyurethane finish, the colors and pattern detail are dispersed uniformly throughout the thickness of the product. Color pigments are insoluble in water and resistant to cleaning agents and light.
 - 2. Homogeneous sheet flooring shall conform to the requirements of ASTM F1913 Standard Specification for Sheet Floor Covering Without Backing
 - 3. Pattern and Color: in [%COLOR%] [color selected from the range currently available from AHF Products.]
 - 4. Width: 6 ft. 5 in. (1.98 m).
 - 5. Length: up to 65.62 ft. (20 m)
 - 6. Thickness: 0.080 in. (2.0 mm)
 - 7. Color: "Herbal Gray" H2008.
- B. Weld Rod:
 - 1. [Provide solid color vinyl weld rod as produced by AHF Products and intended for heat welding of seams. Color shall be compatible with field color of flooring or as selected by Architect to contrast with field color of flooring. Color selected from the range currently available from AHF Products]

C. Seam Adhesive:

1. [Provide Armstrong Flooring S-761 Seam Adhesive at seams as recommended by the resilient flooring manufacturer.]

2.03 PRODUCT SUBSTITUTION

- A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.05 ADHESIVES

- A. Provide Armstrong Flooring [S-995 Sheet Flooring Adhesive Premium Commercial adhesive for field areas and Armstrong Flooring [S-580 Flash Cove Adhesive at flash coving] [S-725 Wall Base Adhesive at the wall base] as recommended by the flooring manufacturer.
- B. For non-heat welded seams: [Provide Armstrong Flooring S-761 Seam Adhesive at seams as recommended by the resilient flooring manufacturer]

2.06 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound].
- B. [For priming porous substrates to aid in adhesive bond strength and reducing subfloor porosity, provide S-464 Prime Strong™ acrylic primer for porous substrates. For non-porous substrates, provide S-465 NP Prime Strong™ acrylic primer for non-porous substrates].
- C. [For creating a moisture barrier, provide S-462 Seal Strong™ two-part moisture mitigation system].
- D. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- E. [Provide top edge trim caps of [plastic] [anodized aluminum] [plastic zero reducer] for integral flash cove as approved by the Architect.]
- F. [Provide a fillet support strip for integral cove base with a minimum radius of 1 in. (2.54 cm) of wood or plastic.]
- G. Provide transition/reducing strips tapered to meet abutting materials.
- H. Provide threshold of thickness and width as shown on the drawings.
- I. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl, or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
- J. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage or overlap.

PART 3 – EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e., moisture tests, bond test, pH test).
- B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

3.03 PREPARATION

- A. [Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 Prime Strong™ epoxy primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to the product installation recommendations and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]
- B. Moisture Testing: (By independent testing agency) Costs for testing shall be borne by the Contractor and shall make all coordination and arrangements with the testing agency. No extra costs will be allowed if flooring installation is postponed due to unacceptably high level of moisture.
 - 1. Perform anhydrous calcium chloride test, ASTM F 1869 48 hours prior to scheduled installation. One test device for each 400 sq. ft. of floor area to receive indicated flooring material. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 2. Copies of test reports shall be submitted to the Architect and the Inspector of Record.
 - 3. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. If moisture level does not drop below the acceptable level before the remainder of the project is completed, a Notice of Completion will be recorded subject to other requirements of these documents.

- C. [Subfloor Preparation Moisture Mitigation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, mitigate moisture and other defects with Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound] [S-462 Seal Strong™ two-part moisture mitigation system] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 Prime Strong™ epoxy primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to the product installation recommendations and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.]
- D. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers, and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate, they must be mechanically removed prior to the installation of the flooring material. Refer to the product installation recommendations and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.
- E. When using S-995 Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" and Bond Tests as described in the Armstrong Flooring Guaranteed Installation System to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. The internal relative humidity of the concrete shall not exceed 95%. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until the results of moisture tests are acceptable. All test results shall be documented and retained.
- F. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

3.04 INSTALLATION OF FLOORING

- A. Install flooring in strict accordance with the latest edition of the flooring installation recommendations. Failure to comply may result in voiding the manufacturer's warranty listed in Section 1.08.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.

- F. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.
- G. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- H. [Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams.] [Prepare sealed seams with special seam adhesive supplied for this purpose.] Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.
- I. [Provide integral flash cove wall base where shown on the drawings, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. [Heat-weld seams] [seam adhesive] as specified for those on the floor].

3.05 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- D. Apply [butt-type] [overlap] metal edge strips where shown on the drawings, [before] [after] flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.06 CLEANING

- A. Perform initial and on-going maintenance according to the latest edition of the maintenance recommendations for Homogeneous Sheet Flooring.

3.07 PROTECTION

- A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing the Job in the latest edition of Armstrong Flooring Guaranteed Installation Systems manual.

END OF SECTION

SECTION 09 68 13 – CARPET TILE

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Modular Carpet Tile
 - 2. Modular Walk-off Mat Tile
- B. Related Sections:
 - 1. Section 09 65 16 Resilient Base and Accessories
 - 2. Section 09 65 19 Resilient Tile Flooring

1.02 SUBMITTALS

- A. Shop Drawing showing columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required as well as direction of carpet pile and pattern, location of edge moldings and edge bindings shall be submitted to the Architect for approval prior to installation.
- B. Floor schedule using same room designations indicated on drawings.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics, sizes, patterns, colors available, and method of installation.
- D. Verification Samples: Submit samples illustrating color and pattern for each carpet material specified.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include maintenance procedures, recommendations for maintenance materials and equipment, and suggested schedule for cleaning.
- G. Manufacturer's Product Warranty.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications
 - 1. Company specializing in manufacturing specified carpet with minimum 10 years documented experience.
 - 2. Upon request, manufacturer to provide representative to assist in project start-up and to inspect installation while in process and upon completion. Representative will notify designated contact if any installation instructions are not followed.
 - 3. Single Source Responsibility: Obtain each type of product from one source and by a single manufacturer.
- B. Installer Qualifications

1. Flooring contractor must be certified by the manufacturer prior to bid.
2. Flooring contractor to be a specialty contractor normally engaged in this type of work and shall have prior experience in the installation of these types of materials.
3. Flooring contractor possessing Contract for the product installation shall not sub-contract the labor without written approval of the Project Manager.
4. Flooring contractor will be responsible for proper product installation, including floor testing and preparation as specified by the manufacturer and JOB CONDITIONS herein.
5. Flooring contractor to provide Owner a written installation warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of one year after job completion.

1.04 DELIVERY, STORAGE, & HANDLING

- A. Deliver materials to the site in manufacturer's original packaging listing manufacturer's name, product name, identification number, and related information.
- B. Store in a dry location, between 60 degrees F and 80 degrees F and a relative humidity below 65%. Protect from damage and soiling. Store in pallet form as supplied by Manufacturer. Do not stack pallets.
- C. Make stored materials available for inspection by the Owner's representative.
- D. Store materials in area of installation for minimum period of 48 hours prior to installation.

1.05 PROJECT CONDITIONS

- A. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document and Manufacturer's installation instructions.
- B. The maximum amount of moisture evacuation from the floor is 5.0 pounds per 1,000 square feet in 24 hours. The acceptable pH level of the substrate is between 7.0 and 9.0. Flooring contractor is responsible for floor testing.
- C. All material used in sub-floor preparation and repair shall be recommended by the carpet manufacturer and shall be chemically and physically compatible with the carpet system being bid.
- D. Maintain minimum 65 degrees F ambient temperature and 65% Relative Humidity for 72 hours prior to, during, and 48 hours after installation.
- E. Do not install flooring until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.06 EXTRA MATERIALS

- A. Provide additional 5% of product for "attic stock."

PART 2 - PRODUCTS

2.01 PRODUCT WARRANTY

- A. Warranty to be sole source responsibility of the Manufacturer. Second source warranties and warranties that involve parties other than the carpet manufacturer are unacceptable.
- B. If the product fails to perform as warranted when properly installed and maintained, the affected area will be repaired or replaced at the discretion of the Manufacturer.
- C. Chair pads are not required, but are recommended for optimum textural performance. Absent the use of chair pads, more intensive maintenance will be required for areas in direct contact with chair caster traffic, and some degree of appearance change is to be expected.
- D. Warranty shall be for a specifically defined period of fifteen years. "Lifetime" warranties are not acceptable.
- E. The fifteen-year warranty shall specifically warrant against:
 - 1. Excessive Surface Wear: More than 15% loss of pile fiber weight
 - 2. Excessive Static Electricity: More than 3.0 kV per AATCC 134
 - 3. Resiliency Loss of the Backing: More than 10% loss of backing resiliency
 - 4. Delamination
 - 5. Edge Ravel
 - 6. Zippering
- F. Tuft Bind warranty in lieu of edge ravel and zippering is not acceptable.

2.02 FIBER

- A. For carpet tile: Nylon Fiber: Dynex SD Bulked Continuous Filament (BCF) Nylon in a loop pile construction.
- B. For walk-off tile: Nylon Finer: TDX® Nylon in a loop pile construction.
- C. Fiber to contain carbon-core filament for permanent static control. Topical treatments are not acceptable.
- D. Durable stain inhibitor should be applied to the fiber during product manufacturing to resist fiber staining and soiling.
 - 1. Initial: Minimum 400 ppm Fluorine per CRI TM-102
 - 2. After two hot water extractions per AATCC 171: Minimum 260 ppm Fluorine per CRI TM-102

2.03 BACKING CHARACTERISTICS

- A. Primary Backing: Synthetic Non-Woven.
- B. Secondary Backing:
 - 1. Density (ASTM D-1667): Min. 65 lbs/cu ft +/- 5%
 - 2. Standard Size: 24" x 24"
 - 3. Fiberglass Reinforced
 - 4. Face yarn fully fused to secondary backing system that will not delaminate.
 - 5. Delamination: No delamination per ASTM D3936

6. Product must not contain pesticides (US EPA Registered Antimicrobials). Installation adhesives are exempt from this section.

2.04 PRODUCT SPECIFICATIONS

A. Manufactured by: Mannington Commercial, Inc., and Shaw Contract.

1. Modular Carpet Tiles, 24" x 24"; Style: **Dispatch. Pattern: Exchange 2 Color: "Haptics" 13143**
 - A. Construction: Stratatec Patterned Loop
 - B. Gauge: 5/64
 - C. Stitch Rate: 8.5 pile units / inch
 - D. Tuft Density: 105 tufts/sq inch
 - E. Pile Height Average: 0.187 inch.
 - F. Fiber System: Dynex SD BCF Nylon with Static Control & Ensure
 - G. Dye Method: 90% Solution Dye & 10 % Yarn Dye
 - H. Static Coefficient of Friction: ASTM C-1028; Passes ADA requirements.
 - I. Static Propensity: AATCC 134: 3.5 kv or less
 - J. Flooring Radiant Panel: ASTM E-648 or NFPA 253: Class 1
 - K. Acoustic Requirements: Noise Reduction Coefficient (NRC): 0.10 Minimum
 - L. Secondary Backing Density: Min. 65 lbs/cu ft +/- 5%
2. Modular Walk-Off Mat Tiles, 24" x 24"; MFR: **Shaw Contract. Style: Bonjour Tile 59411 Collection: Steppin' Out. Color: "Charcoal" 10119.**
 - A. Construction: Symtex®
 - B. Gauge: 1/10
 - C. Stitch Rate: 9.0 pile units/inch
 - D. Pile Height Average: 0.187 inch
 - E. Fiber System: TDX® Nylon
 - F. Dye Method: Solution Dyed
 - G. Static Propensity: AATCC 134: 1.1 kV
 - H. Flooring Radiant Panel: ASTM E-648: Class 1

B. Substitutes/Alternates

Subject to compliance with all requirements, "or equal" must match the selected colors, have similar aesthetic appearance and tuft density, factory-applied "dry" adhesive. Substitution sample and submittals must be submitted for written approval of quality and color at least ten days prior to bid to be considered. Sample of proposed substitute must be inclusive of both the face and proposed backing (color-only sample not acceptable).

2.05 ACCESSORIES

- A. Materials recommended by Manufacturer for patching, leveling, priming, etc.
- B. Base, Carpet Edge, and Transition Strips: As specified in applicable sections.

PART 3 EXECUTION

3.01 EXAMINATION / PREPARATION

4 – 09 68 13 Carpet Tile

- A. Prepare sub-floor to comply with criteria established in Manufacturer's installation instructions. Use only preparation materials that are acceptable to the Manufacturer.
- B. Remove all deleterious substances from substrate(s) that would interfere with or be harmful to the installation.
- C. Remove sub-floor ridges and bumps. Fill cracks, joints, holes, and other defects.
- D. Verify that sub-floor is smooth and flat within specified tolerances and ready to receive carpet.
- E. Verify that substrate surface is dust-free and free of substances that would impair bonding of product to the floor.
- F. Verify that concrete surfaces are ready for installation by conducting moisture and pH testing. Results must be within limits recommended by Manufacturer.
- G. There will be no exceptions to the provisions stated in the Manufacturer's installation instructions.

3.02 INSTALLATION - GENERAL

- A. Install product in accordance with Manufacturer's installation instructions.
- B. Product as installed to be securely attached to the floor in compliance with CBC 11B-302.2.
- C. Where demountable partitions or other items are indicated for installation on top of finished carpet tile floor, install carpet tile before installation of these items.
- D. 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.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Roll with appropriate roller for complete contact of product with adhesive to sub-floor.
- G. Trim carpet neatly at walls and around interruptions. Completed product is to be smooth and free of bubbles, puckers, and other defects.

3.03 PROTECTION & CLEANING

- A. Remove excess adhesive and/or other from floor and wall surfaces without damage.
- B. All rubbish, wrappings, debris, trimmings, etc. to be removed from site and disposed of properly.
- C. Clean and vacuum surfaces using a beater brush/bar commercial vacuum.
- D. After each area is installed, protect from soiling and damage by other trades.

END OF SECTION 09 68 13

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 09 72 16 – VINYL COATED PRE-WRAPPED PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Shop-fabricated, vinyl-wrapped wall panels at Library.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. Samples for Initial Selection: For each type of wall covering indicated.
- C. Samples for Verification: Full width by 36-inch- long section of wall covering from dye lot to be used for each type of wall covering indicated for each color, texture, and pattern required.
- D. Schedule: For wall coverings. Use same designations indicated on Drawings.
- E. Maintenance Data: Two copies of wall coverings to include in maintenance manuals. Resubmit at project close-out.
(Project Close-Out Item)

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: As determine by testing per ASTM E 84.
 - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install wall coverings until spaces are enclosed and weatherproof, 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.

- B. Lighting: Do not install wall covering until a lighting level of not less than 15 fc or a permanent level of lighting is provided on the surfaces to receive wall covering.
- C. Wall coverings are to be installed prior to the installation of any visual display boards and casework referenced in Divisions 10 and 12.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 273; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.2 SHOP FABRICATED VINYL-WRAPPED PANELS:

- A. General: Provide rolls and sheets of each type of wall covering, or preapproved equal, from the same run number or dye lot.
- B. Pre-Wrapped Vinyl Wall Covering Boards:
 - 1. Products:
 - a. Koroseal Wallcoverings, West, Inc.
 - b. Chatfield-Clarke Company, Inc.
 - 2. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the following:
 - a. FS CCC-W-408 and CCFFA-W-101 for Type I, Class A.
 - 3. Backing Material: Mineral-Fiber Board: Maximum flame-spread and smoke-developed indexes of 25 and 10, respectively; minimum density of 13 lb/cu. ft. (208 kg/cu. m).
 - 4. Vinyl Colors, Textures and Patterns: **Group 1, 15 oz: "Beige"**
 - 5. Pre-wrapped board sizes: 48" wide x 96" h, and 120" h as required.

2.3 ACCESSORIES

- A. Use "Korogard" Color Matched or Complimentary Accessory PVC Moldings, wrapped in fabric to match wall panels: Manufacturer's standard. Cap/J-Molding: Plastic #82. Divider Bar: Plastic #87/88. Inside Corner: Plastic #83. Outside Corner "F" molding: Plastic #85.
 - 1. Color: Shall match wall panels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair pre-wrapped board installation, including mold, mildew, oil, grease, incompatible primers, dirt, and dust.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 - 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity.
 - 3. Metals: If not factory primed, clean and apply metal primer.
 - 4. Gypsum Board: Prime with primer recommended by wall-covering manufacturer.
 - 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION

- A. General: Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Install pre-wrapped boards with no gaps or overlaps.
- C. Install over gypsum backing board with adhesive with either nails or screws as required, with approximately 1/8 inch space at joints. Where installed over concrete or masonry substrate, nail with concrete nails to hold for adhesive.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.4 CLEANING

- A. Use cleaning methods recommended in writing by wall-covering manufacturer.
- B. Replace pre-wrapped boards that cannot be cleaned.
- C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 16

SECTION 09 77 50 – FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work specified in this section.
- B. Section 10 26 00 – Impact Resistant Wall Protection.

1.2 DESCRIPTION OF WORK:

- A. Extent of Fiberglass Reinforced (FRP) wall panels required are indicated on drawings and in schedules.
- B. Mounting hardware, adhesives, accessories and trims.

1.3 QUALITY ASSURANCE:

- A. Manufacturer: Obtain panels from a single manufacturer to ensure uniformity in quality of appearance and construction, unless otherwise indicated.

1.4 SUBMITTALS:

- A. Shop Drawings: Submit product literature for approval and verification of panel sizes and anchorage method and location of panels.
- B. Samples: submit full range of color samples for each type of panel system. Colors shall be selected from manufactures standard color selection. Colors to be selected by Architect.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Packaging of panels is the responsibility of the supplier. Secure panels on site in a weather proof location. At time of delivery inspect product for any defects, proper sizes and colors to match submittals. Return damaged or incorrect product and deliver correct and damaged free products in a timely manner.

1.6 PROJECT/SITE CONDITIONS:

- A. Environmental Requirements:
 - 1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation and residual moisture from plaster, concrete or terrazzo work has dissipated.
 - 2. Install panels between 60 degrees F - 75 degrees F (15 - 24 degrees C) and relative humidity below 55%, ideally at the same conditions as the room's normal operating temperatures after building is occupied.

3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

4. Do not install wall system until normal lighting conditions exist.
Normal lighting conditions are described as those in place when the project is finished.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1. Wall, ceilings, floors and openings must be level, plumb, straight, in-line and square

1.7 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official.
Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Warranty Period: 5 years commencing on Date of Substantial Completion.
Warranty extends to products assembled / installed and used in the manner intended and does not cover damage or failure caused by: misuse, abuse or accidents, exposure to extreme temperature, improper installation, improper maintenance and exposure to water or excessive humidity or excessive moisture.

PART 2 - PRODUCTS

2.2 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. NUDO Products Inc.
 - 2. Crane Composites
 - 3. Citadel

2.3 MATERIALS AND COMPONENTS:

- A. Wall panels shall be .09" thick Class A rated.
 - 1. Texture: Smooth
 - 2. Color: White
 - 3. Size: Provide as large as size possible to accommodate the installation as shown or noted on plans with minimal seams.

- B. Flame spread index 25, smoke developed index 335, USDA and FDA approved for food processing plants.
- C. Aluminum moldings are to be installed at all joints and edges of FRP panels per manufacturer's instructions. Use "L" angle, "H" bead, and "J" bead, etc., as manufactured by panel manufacturer.
- D. Stainless Steel Corner Guards are to be installed at all outside wall corners. Type 304 (NSF Standard 51). 3-1/2"x3-1/2"x96", 1/8" radius, 90 degree angle. No. 4 Sating Finish.
- E. Provide adhesive and silicone sealant for installation.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install wall panels using adhesive and sealant as recommended by manufacturer and accepted by all agencies to be compatible with other existing surfaces. Contractor shall prepare existing and new surfaces as necessary for a proper, complete and acceptable installation approved by the manufacturer.
- B. Install moldings and panels true and straight. Inspect substrate material prior to installation and notify Architect if unacceptable to receive FRP panels. Have corrections made to substrate before proceeding. Installation of panels to substrate without notifying of any problems is an acceptance of the material and any problems with the panel installation shall be corrected at no expense to owner.
- C. Install panels per manufactures recommendation over existing or new surfaces. Replace damaged panels due to shipping or installation neglect prior to final inspection.

3.2 ADJUST AND CLEAN:

- A. Protection and Completed Work: Advise Contractor of proper procedures required for protection of installed wall panels from damage or deterioration until acceptance of work.

3.3 PROJECT CLOSE-OUT:

- A. See individual headings in this section for exact requirements.

END OF SECTION 09 77 50

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 09 91 00 – PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field painting of exposed interior items and surfaces, including mechanical and electrical equipment that do not have a factory-applied finish.
- B. Surface preparation and field painting of exposed exterior items and surfaces.

1.2 REFERENCES

- A. ASTM International (ASTM): ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.
- C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.3 DEFINITIONS

- A. General: Standard coating terms defined within Masters Painters Institute (MPI) manual.
 - 1. Gloss level 1 - Flat with a gloss range below 5 when measured at a 60-degree meter and 10 when measured at an 85-degree meter.
 - 2. Gloss level 2 - Low Sheen with a gloss range of 5 to 10 when measured at a 60 degree meter and 10 to 35 when measured at an 85 degree meter.
 - 3. Gloss level 3 - Eggshell with a gloss range between 10 and 15 when measured at a 60-degree meter and 10 to 35 when measured at an 85-degree meter.
 - 4. Gloss level 4 - Satin with a gloss range between 25 to 35 when measured with a 60 degree meter.
 - 5. Gloss level 5 - Semi-Gloss with a gloss range between 50 and 55 when measured at a 60 degree meter.
 - 6. Gloss level 6 - Gloss with a gloss range more than 70 when measured at a 60 degree meter.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. [Product Data]: Manufacturer's data sheets on each product to be used, including:
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Preparation instructions and recommendations.
 - 3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
 - 4. Do not include safety data sheets (MSDS) in submittal.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6

inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 - 3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
- C. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- D. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C), unless manufacturers instructions specifically state's.
- E. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- F. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in

the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

- B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Sherwin-Williams Paints,
102 Cross Street Suite 130, San Luis Obispo, CA 93401
(805) 596-0273
Area Representative: Mike Lechuga Michael.d.lechuga@sherwin.com
- B. Requests for substitutions will be considered in accordance with provisions of Division 01.

2.2 PAINT MATERIALS - GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. VOC Classification: Provide materials, including primers, undercoats, and finish-coat materials, that meet local air quality management district regulations.
- C. Color: Refer to Finish Schedule and Paint Schedule in drawings for paint colors.
- D. Application Rate: Coating thickness for primer, intermediate, barrier and finish coats shall be measured as Dry Film Thickness (DFT) and comply with manufacturer's published recommendations.

2.3 SURFACE REPAIR / STABILIZATION MATERIALS

- A. Hardener / Resin for all exposed exterior end grain, wood that is damaged, slightly decayed, softened, weathered, or in preparation for any epoxy filler:
 - 1. Quick drying, Solvent-borne resin hardener, such as Minwax High Performance Wood Hardener, System 3 End Rot, Abatron Liquid Wood, Smith's Clean penetrating epoxy sealer, or approved equal.
- B. Filler for defects in wood.
 - 1. 2-part Epoxy filler such as Minwax High Performance Wood Filler, System 3 Wood Putty, Abatron Wood Filler, or approved equal.
- C. Filler defects for metal.
 - 1. 2-part Epoxy filler for Metal such as Evercoat "Rage" or approved equal.
- D. Metal Etch / Rust converter for prepping bare steel, rusty, or zinc coated surfaces:
 - 2. Phosphoric Acid metal etch and prep such as Skyco OSPHO Metal Treatment or approved equal.

2.4 EXTERIOR METAL

- A. Ferrous Metal:
 - 1. Primer: B66W01310 Pro industrial Procryl Primer
 - 2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
 - 3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
- B. Galvanized Metal, Aluminum and Copper:
 - 1. Primer: B66W01310 Pro industrial Procryl Primer
 - 2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
 - 3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

2.5 EXTERIOR WOOD

- A. Non-Staining Wood and Hardboard:
 - 1. Primer: B42W08141 Exterior Latex Wood Primer
 - 2. First Coat: A12W00151 A-100 Exterior Low-Sheen Latex
 - 3. Second Coat: A12W00151 A-100 Exterior Low-Sheen Latex
- B. Wood Trim: Doors, Windows, and Shutters:
 - 1. Primer: B42W08141 Exterior Latex Wood Primer
 - 2. First Coat: A12W00151 A-100 Exterior Semi-Gloss Latex
 - 3. Second Coat: A12W00151 A-100 Exterior Semi-Gloss Latex

2.6 EXTERIOR MASONRY, CONCRETE AND STUCCO

- A. Concrete, Stucco, and Brick (Painted Finish):
 - 1. Primer: LX02W0050 LXN Primer WH
 - 2. First Coat: A12W00151 A-100 Exterior Low Sheen Latex
 - 3. Second Coat: A12W00151 A-100 Exterior Low Sheen Latex
- B. Cement-Fiber Board (Painted Finish):
 - 1. Primer: LX02W0050 LXN Primer WH
 - 2. First Coat: A12W00151 A-100 Exterior Low Sheen Latex
 - 3. Second Coat: A12W00151 A-100 Exterior Low Sheen Latex

2.7 INTERIOR GYPSUM WALLBOARD

- A. Smooth Wall Finishes:
 - 1. Primer: B28W08020 – PVA Primer Interior Primer
 - 2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Low Sheen
 - 3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Low Sheen

2.8 INTERIOR PLASTER, CONCRETE, MASONRY

- A. Painted Finish on Plaster and Concrete:
 - 1. Primer: B51W00620 – Prep Rite Pro Block interior/Exterior Latex Primer/Sealer
 - 2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss

2.9 INTERIOR WOOD, HARDBOARD (PAINTED)

- A. Wood and Hardboard (Painted Finish):
 - 1. Primer: B51W00620 – Prep Rite Pro Block interior/Exterior Latex Primer/Sealer
 - 2. First Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss
 - 3. Second Coat: B31W02651 – ProMar 200 Zero VOC Interior Latex Semi-Gloss

2.10 INTERIOR WOOD (FINISHED)

- A. Wood and Hardboard (Stained or Finish):
 - 1. Primer: None
 - 2. First Coat: Minwax Indoor/Outdoor Helmsman Spar Urethane, Satin
 - 3. Second Coat: Minwax Indoor/Outdoor Helmsman Spar Urethane, Satin

2.11 INTERIOR METAL

- A. Ferrous Metal:
 - 1. Primer: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
 - 2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
 - 3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
- B. Galvanized Metal and Aluminum:
 - 1. Primer: B66W01310 Pro industrial Procryl Primer
 - 2. First Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss
 - 3. Second Coat: B66W01151 Pro Industrial DTM Acrylic Semi Gloss

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
 - 2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances

that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
 3. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
 - a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 4. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
 - b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
 - c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - d. Determine moisture content of surfaces by performing a moisture test. Do not coat if moisture content exceeds 15 percent.
 5. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
 6. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
 - a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.

3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Number of Coats: A minimum of one (1) prime coat and two (2) finish coats shall be required for all paints and surfaces.
- C. General: Apply high-performance coatings according to manufacturer's written instructions.
 1. Use applicators and techniques best suited for the material being applied.
 2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
 3. Coating surface treatments, and finishes are indicated in the coating system descriptions.
 4. Provide finish coats compatible with primers used.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
- D. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 1. The number of coats and film thickness required is the same regardless of application method.
 2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
- C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Markerboards.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood blocking.

1.3 DEFINITIONS

- A. Visual Display Boards: Markerboards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show location of panel joints, anchors, reinforcement, accessories, layout and installation details.
 - 2. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
 - 1. Actual sections of porcelain-enamel face sheet.
 - 2. Samples of accessories involving color selection.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl and polyester fabrics.
- E. Qualification Data: For Installer.
- F. Certification: Submit manufacturer's certification that materials comply with the specified requirements.
(Project Close-Out Item)

- G. Maintenance Data: 2 copies each of visual display surfaces to include in maintenance manuals.
(*Project Close-Out Item*)

- H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

- 1. Manufacturer must have five (5) years minimum experience under one manufacturer's name.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

- B. Store visual display units vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Sequence: Sequence of installation requires all wall coverings referenced in Division 9 to be in place prior to installation of any casework visual display Surfaces.

1.8 WARRANTY (*Project Close-Out Item*)

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces become slick or shiny.
 - c. Surfaces exhibit crazing, cracking, or flaking.

- 2. Warranty Period: 50 years from date of Substantial Completion.

- 3. Replacement is limited to material replacement only; labor for removal and reinstallation is not included.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Product: Subject to compliance with requirements, provide product specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.0236-inch uncoated thickness; with 2 coat porcelain-enamel coating, ground coat and color cover coat, fused to steel at approximately 1500 deg F. Concealed face with a 1 coat process consisting of a ground coat.
1. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.
- B. Particleboard: ANSI A208.1, Grade 1-M-1.
- C. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.3 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.024-inch- thick, porcelain-enamel face sheet with low-gloss finish.
1. Manufacturers:
 - a. Best-Rite Manufacturing.
 - b. Claridge Products & Equipment, Inc..
 - c. Polyvision
 - d. Platinum Visual Systems, ABC School Equipment.
 2. Particleboard Core: 1/2 inch thick; with 0.015-inch- thick, aluminum sheet backing.
 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
 4. Subject to compliance, manufacturer shall be Nelson Adams 500 Series, or equal.
- B. Sizes: 4'-0" by 8'-0" (or as shown on the Drawings).

2.4 MARKERBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; of size and shape indicated.

1. Factory-Applied Trim: Manufacturer's standard box style trim, to eliminate grounds.
- B. Chalktray: Manufacturer's standard, continuous.
 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
- C. Map Rail: Provide the following accessories:
 1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
 2. End Stops: Located at each end of map rail.
 3. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.
 4. Flag holder: Cast aluminum.

2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.

- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.
- C. Examine walls and partitions for proper backing for visual display surfaces.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to wood backing in walls.
 - 1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.
 - a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 10 11 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Panel signs.
- 2. Signage accessories.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
 - 2. Wiring Diagrams: For signs with illuminated characters.
- C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.
- D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
 - 2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
 - 3. Casting: Show representative texture, character style, spacing, finish, and method of attachment.
 - 4. Approved samples will not be returned for installation into Project.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals. *(Project Close-Out Item)*

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by signage manufacturer.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA); CAC, Title 24, 2019 CBC Chapters 10 & 11B and with code provisions as adopted by authorities having jurisdiction.
 - 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Illuminated Exit Signs: Refer to Division 26.
 - b. Signs for Accessible Spaces.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
 - 1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/32 inch measured diagonally.

B. Manufacturers:

1. Garnet Sign Studio (San Francisco, CA)
2. Classic Signs & Awards (Concord, CA)
3. Designer Sign Systems (San Jose, CA)

C. Plastic Laminate: Provide high-pressure laminate engraving stock with face and core plies in contrasting colors as selected by Architect from manufacturer's full range.

D. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.

E. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.

F. Graphic Content and Style: Provide sign copy that complies with requirements indicated on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

G. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by California Contracted Grade 2 braille. Produce precisely formed characters with domed cut edges free from burrs and cut marks.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch.
3. Dots shall be 0.100 inch on center in each cell with 0.300 inch space between cells, domed or rounded raised, 0.059 inch to 0.063 inch in diameter.

H. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply. Sign inserts shall be routed from Rowmark "Ultramattes" reverse engravable laminate acrylic plastic, colors to be selected from Rowmark's standard color chart. Letters, numbers and symbols shall be either laser cut or machine profile cut from Rowmark "ADA Alternative Appliqué" material and applied to the surface using 3M 467MP Hi Performance Adhesive Sheeting.

2.3 PANEL SIGN TYPES

A. Room Signs & Identification Signage:

1. Material: Plastic laminate.
2. Copy: Tactile and braille.
3. Character Style: Univers 55.
4. Text: As indicated.
5. Message: Fixed.
6. Sizes:

- a. Sign: Room name: 4 inch by 10 inch unless legend requires a longer sign.
 - b. Character: Minimum 1-inch high characters. Centered on background and centered on aluminum frame.
 7. Colors:
 - a. Character: As selected by Architect from manufacturer's full range.
 - b. Background: As selected by Architect from manufacturer's full range.
- B. Assisted Listening Device Sign:
 1. Material: Plastic laminate.
 2. Perimeter: none
 3. Copy: Engraved.
 4. Character Style: Univers 55.
 5. Text: As indicated on the Drawings.
 6. Message: Fixed.
 7. Sizes:
 - a. Sign: Comply with Section 11B-703.5, 2019 C.B.C.
 - b. Character: Comply with Section 11B-703.5, 2019 C.B.C.
 8. Colors:
 - a. Character: White
 - b. Background: As selected by Architect from manufacturer's full range
- C. Toilet Room Signs:
 1. Material: Cast-acrylic sheet, ¼ inch thick.
 2. Perimeter: Unframed at door and wall mounted signs.
 3. Copy: Raised. (Grade 2 Braille, California contracted)
 4. Character Style: Univers 55.
 5. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
 6. Message: Fixed.
 7. Sizes:
 - a. Sign:
 - 1) "Boys" – Equilateral triangle, 12 inches on a side. Door mounted.
 - 2) "Girls" – Circle, 12 inches diameter. Door mounted.
 - 3) "Unisex" - Equilateral triangle superimposed over a 12-inch circle. Door mounted.
 - b. Character: Minimum 1-inch high characters. Grade 2 Braille at accessible facilities.
 8. Colors:
 - a. Character: Contrasting color to door as selected by Architect.
 - b. Background: Contrasting color to door as selected by Architect.

2.4 ACCESSORIES

- A. Vinyl Film: Provide opaque nonreflective (interior) and reflective (exterior) vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, and electrical power provided under other sections of Work are sized and located to accommodate signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions unless otherwise indicated.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Shim Plates: Provide 1/8-inch- thick shims as required for level mounting, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
2. Non-Exposed Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes in aluminum frames. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
3. Adhesive tape: Use 3M VHB double sided foam tape to attach signs to substrates. Apply tape all around perimeter of sign panels.
4. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials, or sign on opposite side of glass of matching size.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 00 - TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid plastic toilet compartments including the following: Hiny Hiders by Scranton Products
 - 1. Floor mounted overhead-braced toilet compartments.
 - 2. Floor-to-ceiling toilet compartments.
 - 3. Ceiling hung toilet compartments.
 - 4. Privacy screens.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- B. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.
- C. Verification Samples: For each finish product specified, provide owner and architect a sample representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

- A. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments.
- B. Performance Requirements:
 - 1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84:

- a. Class A flame spread/smoke developed rating.
- b. Class B flame spread/smoke developed rating.
- 2. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA) 286: Pass.
 - b. International Code Council (ICC): Class B.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Scranton Products, which is located at: 801 E. Corey St.; Scranton, PA 18505; Toll Free Tel: 800-445-5148; Fax: 855-376-6161; Email: [request info \(info@scrantonproducts.com\)](mailto:requestinfo@scrantonproducts.com); Web: www.scrantonproducts.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIAL

- A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.
- B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.
- C. Stainless Steel Castings: ASTM A167, Type 304.
- D. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENTS

- A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.
 - 1. Style: Floor mounted overhead-braced toilet compartments.
- B. Panel Color: Traditional Series.
 - 1. Glacier Grey - Orange Peel.
- C. Pilaster Shoes: 3 inches (76 mm) high type 304, 20 gauge stainless steel. Secured to pilasters with a stainless-steel tamper resistant Torx head sex bolt.

- D. Headrail: Heavy-duty extruded 6463-T5 alloy aluminum with anti-grip design. Finish to be clear anodized. Fastened to headrail brackets with stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.
 - 1. Headrail Brackets: 20 gauge stainless steel with satin finish. Secured to the wall with stainless steel tamper resistant Torx head screws.
- E. Wall Brackets:
 - 1. Aluminum Brackets: Heavy-duty aluminum 6463-T5 alloy.
 - 2. Brackets are fastened to pilasters with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
- F. Door Hardware:
 - 1. Continuous Piano Hinge
 - 2. Stainless Steel Paddle Latch and Housing: Heavy-duty stainless steel type 304. Bright finish.
 - 3. Doors supplied with one coat hook/bumper and door pull made of chrome plated Zamak.
 - 4. Equip outswing handicapped doors with second door pull and door stop.

2.4 SOLID PLASTIC PRIVACY SCREENS

- A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.
- B. Panels, and pilasters, if required, 1 inch (25 mm) thick with edges rounded to a radius. Screens to be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.
- C. Screen Type: Wall mounted.
 - 1. Urinal Screens: 18 inches (457 mm) wide by 55 inches (1397 mm) high.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.
- C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

inch (9.5 mm).

- D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.
- E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Toilet and bath accessories.
- 2. Underlavatory guards.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Samples: For each accessory item to verify design, operation, and finish requirements.
- C. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations. (*Project Close-Out Item*)
- E. Design Calculations: Computations demonstrating design and/or test data to Architect for review and/or submittal to the Division of the State Architect. Design calculations shall be proposed and signed by a registered professional engineer to comply with the requirements of the 2019 C.B.C., Section 11B-609.8 regarding structural strength of grab bars, fasteners and mounting devices to be secured to the toilet partitions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.
- B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY *(Project Close-Out Item)*

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
 1. Manufacturer's written 1 year warranty against defects in materials and workmanship on all accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:
 1. Toilet and Bath Accessories:
 - a. American Specialties, Inc.
 2. Underlatory Guards:
 - a. Brocar Products, Inc.
 - b. Truebro, Inc.
- B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Toilet and Bath Accessories.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

- B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
- C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
- G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

- A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
 - 1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
- E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
 - 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
- F. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- D. Toilet Tissue Dispensers: Supplied by District and installed by Contractor. 3 inch maximum profile from wall surface in accessible stalls, typical.
- E. Paper Towel Dispensers: Supplied by District and installed by Contractor.
- F. Soap Dispensers: Supplied by District and installed by Contractor.
- G. Seat-Cover Dispenser: Supplied by District and installed by Contractor.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORIES

- A. Paper Towel Dispenser: O.F.C.I.
- B. Toilet Tissue Dispenser: O.F.C.I.
- C. Soap Dispenser: O.F.C.I.

- D. Grab Bar: Where this designation is indicated, provide stainless-steel grab bar complying with the following:
1. Products: ASI 3800
 2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
 3. Mounting: Concealed with manufacturer's standard flanges and anchors.
 4. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
 5. Outside Diameter: 1-1/4 inches for medium-duty applications.
 6. Clearance: 1-1/2 inches from wall to inside face of bar.
- E. Sanitary Napkin Disposal Unit: Where this designation is indicated, provide stainless-steel sanitary napkin disposal unit complying with the following:
1. Products: ASI 20852
 2. Surface Mounted Type: With seamless exposed walls; self-closing top cover; locking bottom panel with stainless-steel, continuous hinge; and removable, reusable receptacle.
- F. Seat-Cover Dispenser:
1. Products: ASI 0477-SM
 2. Surface-Mounted Type: Stainless-steel unit with concealed opening at bottom for filling; minimum 250-seat-cover capacity.
- G. Mirror Unit: Where this designation is indicated, provide mirror unit complying with the following:
1. Products: ASI 0600-A, size 18x30
 2. Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.
- H. Underlavatory Guard: Where this designation is indicated, provide underlavatory guard complying with the following:
1. Products: Provide one of the following:
 2. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.
- I. Coat Hook / Bag Hook:
1. Products: ASI 7345-S or equal.
 2. Surface mounted type. Extends 2" from wall.

END OF SECTION 10 28 13

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 10 44 00 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Portable fire extinguishers.
- 2. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- 3. Mounting brackets for fire extinguishers.

- B. Related Sections include the following:

- 1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping sealants at fire-rated cabinets.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.

- 1. Fire Extinguishers: Include rating and classification.
- 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.
(Project Close-Out Item)

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. Code Compliance: Fabricate and label fire extinguishers to comply with CCR Title 19, Div. 1 Public Safety, Section 596 and NFPA 10.

- C. Fire Extinguishers: UL Listed and labeled for type, rating, and classification.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.6 WARRANTY *(Project Close-Out Item)*

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 3 mm thick, single strength.

2.3 PORTABLE FIRE EXTINGUISHERS

- A. Manufacturers:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.

- B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Valves: Manufacturer's standard.
 - 2. Handles and Levers: Manufacturer's standard.
 - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- C. Regular Dry-Chemical Type in Steel Container 40-B:C, 10-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container. (At Kitchens.)
- D. Multipurpose Dry-Chemical Type in Steel Container 2-A:10-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.4 FIRE-PROTECTION CABINET

- A. Manufacturers:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Construction: Non-rated, (1-hour fire rated, 2-hour fire rated, where indicated on the Drawings).
- D. Cabinet Material: Enameled-steel sheet.
- E. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Surface-Mounted Cabinet (where indicated): Cabinet box fully exposed and mounted directly on wall; with no trim.
- G. Cabinet Trim Material: Steel sheet.
- H. Door Material: Steel sheet.
- I. Door Style: Center glass panel with frame.
- J. Door Glazing: Clear float glass, 1/8 inch thick.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting lever handle with cam-action latch or projecting door pull and friction latch.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
3. Door Hardware to be accessible per 1125B.4.
4. Provide locking cabinet, selected from manufacturers standard products.

L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to location indicated on Drawings.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Horizontal, unless otherwise indicated.

M. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet , door, and trim, except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.

2.5 MOUNTING BRACKETS

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish. Location where designated on the drawings

1. Color: Black.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

- D. Backboard: $\frac{3}{4}$ inch MDO plywood with eased edges and anchored to wall, is to be provided under this Section. Board to be of sufficient size to accommodate extinguisher and lettering. Board to be field painted under Division 9 "Painting".

2.6 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material.
 - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated on the Drawings. Comply with applicable regulation of governing authorities.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 1. Provide inside latch and lock for break-glass panels.
 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply at locations indicated.
- E. Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Architect.
- F. Fire Extinguishers shall not be mounted higher than 5 feet from floor level to the top of the fire extinguisher per Title 19, Section 596.4. Mount at +48" A.F.F. maximum to handle. Provide release for disabled access 5 lbf maximum operation.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 12 35 13 – PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Plastic laminate casework
 - 2. Hardware typically furnished by the casework manufacturer
 - 3. Shelving
 - 4. Structural supports incorporated into wood casework
- B. Excluding:
 - 1. Metal support brackets and fittings that are part of the building structure
 - 2. Plumbing, electrical fixtures, and telephone equipment
- C. Related sections:
 - 1. Division 6 – “Rough carpentry” for wood blocking or grounds inside finished walls or above finished ceilings.

1.02 REFERENCES

- A. The *North American Architectural Woodwork Standards (NAAWS)*, latest edition. Jointly published by Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada.

1.03 SUBMITTALS

- A. Shop drawings:
 - 1. Submit shop drawings in conformance with the requirements of the *North American Architectural Woodwork Standards*.
 - 2. Furnish a Woodwork Institute Certified Compliance Label on the first page of the shop drawings.
 - 3. Submit two copies, one of which will be returned with reviewed notations. Make corrections noted (if any), and distribute required copies prior to the start of work.
- B. Samples:
 - 1. Submit four finished samples of each species and cut of wood to be used. Lumber samples to be minimum 6 inches by 18 inches, and sheet product samples to be minimum 12 inches square. Samples shall represent the range of color and grain expected to be provided.
 - 2. Submit a sample in the specified finish of each hardware item that will be visible at exposed surfaces when the job is complete.

1.04 QUALITY ASSURANCE

- A. Work shall be in accordance with the Grade or Grades specified of the *North American Architectural Woodwork Standards*.
- B. Certified Compliance

1. Before delivery to the job site, provide a Woodwork Institute Certified Compliance Certificate indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the *NAAWS* Grade or Grades specified.
2. Provide a Woodwork Institute Certified Compliance Label on each elevation of casework.
3. At completion of installation provide a Woodwork Institute Certified Compliance Certificate indicating the products installed, and certifying that the installation of these products fully meets the requirements of the *NAAWS* Grade or Grades specified.
4. All fees charged by the Woodwork Institute for its Certified Compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.

C. Qualification:

1. Firm (woodwork manufacturer) with no less than five years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this section.

D. Single source responsibility: A single manufacturer shall provide and install the work of described in this section.

1.05 DELIVERY STORAGE AND HANDLING

- A. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.
1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean.
 2. Maintain indoor temperature and humidity within the range recommended by the *North American Architectural Woodwork Standards* for the location of the project.

1.06 SCHEDULING

- A. Coordinate fabrication, delivery, and installation with the general contractor and other applicable trades.

PART 2 – PRODUCTS

2.01 COMPONENTS

- A. Lumber: In accordance with the *North American Architectural Woodwork Standards* Grade specified for the product being fabricated. Moisture Content: 6% to 12% for boards up to 2-inch (50.8 mm) nominal thickness, and shall not exceed 19% for thicker pieces.
- B. Core: MDF meeting the requirements of *North American Architectural Woodwork Standards*.
1. Made with no added urea formaldehyde.
 2. Water-resistant core, where required: MDF meeting the requirements of ANSI A 208.2 Grade 155 MR-50.
- C. Veneer core plywood: A non-telegraphing hardwood manufactured with exterior glue.
- D. Plastic laminate: Meeting the requirements of the *North American Architectural Woodwork Standards* for its use.
1. Manufacturers:
 - a. Wilsonart – “High Wear Laminate”
 - b. Nevamar Corp. – “Hi-Wear Laminate”

- E. Edgeband: PVC or ABS matching the color and pattern of the exposed laminate.
- F. Adhesives: Type II, water-resistant
- G. Hardware:
 - 1. Finish: US28 and /or US32D.
 - 2. Pulls: 4-inch U shaped handles for drawers and hinged doors. Epco DP430.
 - 3. Drawer guides: Full extension.
 - a. Meeting the requirements of NAAWS for the type and size of drawer.
 - b. File drawers: Full extension. Minimum 100-pound capacity except 150-pound capacity for lateral files.
 - 4. Hinges: Five-knuckle Grade 1 hinges, with hospital tips, Rockford Process or Equal.
 - 5. Door catches: HD Type
 - 6. Shelf supports: Steel with pins for ¼ inch drilled holes with earth quake pins to hold shelves against lateral movement, Hettich, Sekura # 6, or approved equal.
 - 7. Locks:
 - a. Door locks: 5 pin tumbler, model #500DR.
 - b. Drawer locks: 5 pin tumbler, model #600DW.
 - c. Keying: Each room keyed alike.
 - 8. Elbow catches: HD type, all inactive doors.

2.02 FABRICATION

- A. Grade: NAAWS Custom Grade.
- B. Exposed exterior surfaces: High-pressure decorative laminate.
 - 1. Color and pattern – **Vertical surfaces: Wilsonart – Beigewood matte, #7850-60.**
 - 2. Color and pattern – **Countertop: Wilsonart – Graphite Nebula matte, #4623-60.**
- C. Exposed interior surfaces: High-pressure laminate matching exposed surfaces.
- D. Semi-exposed surfaces: Low-pressure melamine overlay.
 - 1. Color: **White.**
- E. Cabinet construction type: Frameless.
- F. Door Interface Style: Flush overlay.
- G. Edgeband: PVC or ABS, matching the color and pattern of the exposed laminate.
 - 1. Edgeband at doors and drawer fronts: 3mm PVC or ABS.
- H. Drawers:
 - 1. Sides: Seven-ply hardwood plywood with no internal voids.
 - 2. Bottoms: Hardwood plywood of the same species and cut as the drawer sides. Bottoms shall be fully housed into drawer sides, backs, and subfronts, and securely glued.
 - 3. Joinery: Dowels

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify the adequacy and proper location of any required backing or support framing.
- B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this section are in place and ready.

3.02 INSTALLATION

- A. Install all work in conformance with the *North American Architectural Woodwork Standards*, latest edition.
 - 1. Installation shall conform to the *NAAWS* grade of the items being installed.
- B. All work shall be secured in place, square, plumb, and level.
- C. All work abutting other building components shall be properly scribed.
- D. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
- E. Equipment cutouts shown on plans shall be cut by the installer.
- F. Operable parts for all accessible casework shall comply with CBC Section 11B-309.

3.03 ADJUSTING AND TOUCH UP

- A. Before completing installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
- B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.04 CLEANUP

- A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor.

END OF SECTION

SECTION 22 00 00

PLUMBING GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

- A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.
- B. Consult all other Sections to determine the extent of this work specified elsewhere.
- C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

- A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:
 - 1. California Building Code
 - 2. California Electrical Code
 - 3. California Plumbing Code
 - 4. California Mechanical Code
 - 5. California Energy Code
 - 6. California Green Buildings Standard
 - 7. California Fire Code
 - 8. National Fire Protection Association

1.4 QUALITY ASSURANCE

- A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner's insurance underwriter.
- B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

- A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities within Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

- A. Secure and pay for all permits, licenses, inspections, and fees required.
- B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

- A. Paint all exposed piping and supports.
- B. See Division 09 for painting.

1.8 COORDINATION

- A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.
- B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.
- C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

- D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.
- E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.
- F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.
- G. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.
- H. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.
- B. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.
- C. Furnish all materials and equipment of the same type by the same manufacturer.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

- A. No substitute materials or equipment may be installed without the written approval of the Architect.
- B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.
- C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.
- D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.
- D. Items indicated in submittal comments shall be provided and installed by contractor.
- E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.
- F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.
- G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.
- H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.
- I. Submittals will be returned to indicate appropriate action taken as follows:
 - 1. No Exceptions Taken.
 - 2. Make Corrections Noted. No Resubmittal Required.
 - 3. Revise and Resubmit.
 - 4. Rejected.
 - 5. Not Reviewed.
- J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:
 - 1. Project name.
 - 2. Date.
 - 3. Name and address of Architect and Engineer.
 - 4. Name of Owner.

5. Name, address and contact information of Contractor.
 6. Names and contact information of sub-contractor, manufacturer, and supplier.
 7. Name of entity that prepared submittal.
 8. Category and type of submittal.
 9. Specification Section number and title.
 10. Drawing number and detail references, as appropriate.
 11. Transmittal number, numbered consecutively, and revision number clearly identified.
 12. Each item submitted labeled or identified the same as on the drawings.
- K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.
- L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.
- M. Provide a bookmark for each submittal section. Include a table of contents at beginning of submittal.
- N. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.
- O. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.
- P. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

- A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.
- B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.
- C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.
- D. Follow manufacturer's instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.
- E. All requests for information shall be accompanied with Contractor's proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

- A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

- A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.
- B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.
- C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.
- D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

- A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.
- B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.
- C. Record drawings must include the following as a minimum:
 - 1. Actual equipment locations.
 - 2. Revisions or substitutions to equipment schedules.
 - 3. Pipe size and routing.
 - 4. Dimensional changes to drawings.

5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

3.4 PROTECTION OF BUILDING

- A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.
- B. Provide proper protection and storage of all items and tools required.
- C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.
- C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.
- D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.
- E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.
- F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

3.7 QUALITY OF WORK

- A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.
- B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 FURRING AND PIPE SPACES

- A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.
- B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

3.9 CUTTING AND PATCHING

- A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.
- B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- C. All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved prior to execution of any construction. At all structural concrete to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.
- E. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

3.10 ACCESS

- A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

- B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.
- C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.
- D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.
- E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.11 SEISMIC RESTRAINTS

- A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.
- B. Piping shall be braced as follows:
 - 1. Brace all gas piping that is 1" nominal diameter and larger.
 - 2. Brace all piping located in mechanical equipment rooms that is 1 1/4" nominal diameter and larger.
 - 3. Brace all piping that is 2 1/2" nominal diameter and larger.
 - 4. Transverse bracings at 40'-0" on center maximum (minimum of one brace per direction of run).
 - 5. Longitudinal bracings at 80'-0" on center maximum (minimum of one brace per direction of run).
 - 6. Transverse bracing shall be 20'-0" on center maximum and longitudinal bracing at 40'-0" on center maximum for gas piping and piping in mechanical rooms.
 - 7. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24" of the elbow or tee and is connected to the largest pipe.
 - 8. Do not use branch lines to brace main lines.
 - 9. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.
 - 10. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30'-0" on center.
 - 11. No bracing is required if the top of single pipe is suspended 12" or less from the connection point at the supporting structural member.

3.12 MANUFACTURER'S DIRECTIONS

- A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.
- B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.
- C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

- A. Do not install piping, equipment, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.
- B. Do not install piping or equipment within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.14 CATHODIC PROTECTION

- A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

- A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.
- B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.
- C. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.16 GUARANTEE

- A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

- B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.17 TESTING

- A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.18 OPENINGS

- A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.19 CLEAN-UP

- A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean, and in a condition acceptable to the Architect.
- B. Clean all work installed under this Contract to satisfaction of Owner.

3.20 PUNCH LIST

- A. Respond to Architect's punch list in writing within 10 days of receipt. Include action plan and an estimated timeline for completion.
- B. Submit photographs of completed items.

3.21 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.
- B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.
- C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.22 OPERATING AND MAINTENANCE MANUALS

- A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.
- B. Provide the following equipment and maintenance information where applicable:
 - 1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.

2. Identifying equipment manufacturer, product name, and model number.
 3. Locations.
 4. Wiring Diagrams.
 5. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
 6. Assembly and disassembly instructions.
 7. Startup procedures.
 8. Routine and normal operating instructions.
 9. Normal and emergency shutdown instructions.
 10. Troubleshooting diagnostic instructions.
 11. Parts list and recommended spare parts including name and address of source of supply.
- C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.
- D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.
- E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION

SECTION 22 05 00

PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 22 Sections apply to this Section.

1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, and services to furnish and install complete plumbing and piping systems which shall include, but not limited to fixtures, equipment, piping, valves, and supports.

1.3 SUBMITTALS

- A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:
 - 1. Plumbing fixtures and trim.
 - 2. Water Heaters.
 - 3. Piping and fittings.
 - 4. Insulation.
 - 5. Pipe hangers and supports.
 - 6. Valves.
 - 7. Drains and cleanouts.
 - 8. Trap primers and water hammer arrestors.
 - 9. Coordination Drawings: plans and details, drawn to scale, on which piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. No substitute materials or equipment shall be installed without the written approval of the Architect.
- C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.
- D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

- A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

- B. Pipe welding qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer's name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor's expense.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES, TRIM AND ACCESSORIES

- A. See Schedules on Drawings for plumbing fixtures. Furnish and install all fixtures in accordance with Drawings, manufacturer's recommendations, and all applicable codes.
- B. Fixture locations and heights as shown on Architectural Drawings.
- C. Comply with applicable provisions and recommendations of CALGreen for water conservation measures.
- D. Provide fixtures complete with all trim and materials, fittings, supports, fastening devices, faucets, valves, traps, and appurtenances required.
- E. Lavatories and sinks shall be provided with required number of holes by faucet only, unless otherwise specified or required.
- F. Install fixtures level, plumb and set at right angles to wall, floor, or both unless otherwise indicated.
- G. Make connections between fixtures and waste pipe gastight and watertight with neoprene type gaskets or bowl wax.
- H. Where fittings, trim, and accessories are exposed or semi-exposed, provide chrome plated 17 gauge seamless brass.
- I. Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons with setscrews.
- J. Vitreous china: unmarked, true, clear, smooth and bright. Color shall be white unless otherwise indicated.

- K. Porcelain lined ware: constructed of smooth, sound iron castings, properly finished, and provided with first quality, high temperature enamel.

2.2 ELECTRIC WATER HEATERS – POINT OF USE

- A. Acceptable manufacturers: Chronomite, Eemax.
- B. Commercial grade, factory assembled and wired, electric type with capacities as listed on the Drawings.
- C. Heater shall be ETL or UL listed and shall bear the UL or ETL label.
- D. Heater shall meet the energy efficiency requirements of California Title 24.
- E. Provide a two (2) year manufacturer's commercial installation warranty for the entire unit.

2.3 WATER PIPING AND FITTING MATERIALS

- A. All water piping shall comply with NSF/ANSI Standard 372 for low lead requirements.
- B. Above Grade: ASTM B88, Type L copper tubing, hard temper with wrought copper fittings.
- C. Below Grade: ASTM B88, Type K copper tubing, hard temper with wrought copper fittings.
- D. Joints: 1/2" to 1-1/2" pipe sizes soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders unless otherwise indicated.
- E. Joints: 2" and larger pipe sizes brazed using AWS A5.8/A5.8M, AWS BCuP Series copper-phosphorous alloys.
- F. Water Hammer Arrestors: Provide at quick closing valves such as flush valves, etc. Certified under Plumbing and Drainage Institute Standard WH201 and by ASSE Standard 1010.
- G. Select and size water hammer arrestors in accordance with Plumbing and Drainage Institute Standard WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.
- H. Insulation: Insulate outdoor piping with 1" Glass Fiber Insulation and 0.016 aluminum jacket.

2.4 HOT WATER PIPING INSULATION

- A. Acceptable manufacturers: Johns Manville, Owens Corning, Knauf.
- B. Glass Fiber: Conforming to ASTM C547, rigid molded, non-combustible.
 - 1. Installed thermal conductivity: 0.23 btu-inch per hour-ft²-°F at 75°F.
 - 2. 1" thickness.
 - 3. Owens-Corning SSLII with ASJ max or other equal.
- C. All insulated piping installed indoors in exposed locations shall be protected with PVC jacketing.
- D. All insulated piping installed outdoors shall be protected with 0.016 inch thick aluminum jacketing.

- E. All insulation shall in accordance with the California Energy Code.

2.5 WATER PIPING VALVES

- A. All valves shall be the product of a single manufacturer. Milwaukee, NIBCO, Stockham, Crane, or approved equal. 125 PSIG steam service rated and 300 PSIG air and water rated. All valves shall be low lead type per NSF/ANSI Standard 372.
- B. Provide valves with screwed or flanged ends as required by the piping system in which they are installed.
- C. Shut-off valves 2 inches and smaller: Ball Valve. Bronze body, two piece, full port, extended handle that allows operation of valve without disturbing the insulation.
- D. Shut-off valves 2 1/2 inches and larger: Gate Valve. Iron body, resilient wedge, outside screw and yoke.
- E. Check valves: Bronze body, swing check, screwed. Provide non-slam check on pumped equipment or quick closing fixtures.
- F. Relief valves: Bronze body, spring and diaphragm combination pressure and temperature relief valves with test lever and automatically resetting type thermostatic element. Tested under ANSI Z21.22 and rated relief capacities greater than water heater's input rating.

2.6 WASTE AND VENT PIPING AND FITTING MATERIALS

- A. Above Grade Waste and Vent: Hubless cast iron soil pipe and fittings, service weight per ASTM A888 and Cast-Iron Soil Pipe Institute Standard (CISPI) 301. Couplings conforming to ASTM and CISPI 310; stainless steel covered neoprene gasket sleeve and stainless steel clamps.
- B. Below Grade Waste and Vent: ABS Schedule 40 per ASTM D2661 D2680 or PVC Schedule 40 per ASTM D17885 D2665 with solvent weld socket fittings.
- C. Above Grade Vent alternate: ABS Schedule 40 per ASTM D2661 D2680 or PVC Schedule 40 per ASTM D1785 D2665 with solvent weld socket fittings may be used for above grade vent.
- D. Traps: Provide traps at all fixtures connected to waste systems, except for fixtures having integral traps. Type of trap(s) shall be approved by local codes and be of same material as piping system. Exposed traps for fixtures shall be chrome plated 17 gauge brass.
- E. Trap Primers: Pressure drop activated brass trap seal primer with view holes and removable filter screen and requires no adjustments or air pre-charge. Select appropriate model for number of drains being served. Precision Plumbing Products, MIFAB, or approved equal.
- F. Drains: Size of drain outlets shall be same as connecting pipe and as indicated on Drawings. Provide trap primer connections on all drains. Drain outlet as required for connection to piping.
- G. Temperature and Pressure Relief Drain: Material shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A 112.4.1.

- H. Cleanouts: Install cleanouts of same diameter as pipe (4 inch maximum) where indicated or required by code. Cleanouts shall be installed at all points of change in direction and in horizontal waste lines over 50 feet inside building and 100 feet outside building. Locate minimum 18 inches away from building construction to allow sufficient space for rodding.
1. Provide cleanouts in waste drop from each sink and urinal. Provide one wrench for each size and type of cleanout used.
 2. Floor Cleanouts: ZURN Z1400 series, or approved equal. Nickel-bronze, round top, with vandal proof screws.
 3. Wall Cleanouts: ZURN Z1446 series, or approved equal with stainless steel cover and vandal proof screws.
 4. Unfinished Areas: Zurn Z1440, or approved equal. Cast iron cleanout.
 5. Grass or Planting Area: Zurn Z1449, or approved equal. Locate in concrete box and cover.
- I. In ground cleanouts outside building shall be back-to-back tee/wye pair.

2.7 CONDENSATE DRAIN PIPING

- A. Condensate drain piping shall be type DWV copper with wrought copper fittings. Condensate drain piping may also be Type L or M copper pipe with wrought copper fittings.
- B. Condensate drain piping inside building shall be insulated with 1" thick closed cell elastomeric foam insulation. Armaflex, Aeroflex, or approved equal.

2.8 UNIONS AND FLANGES

- A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, or vent piping. Dielectric unions installed in potable water systems shall conform to lead free requirements.
- B. Install unions in piping 2" and smaller and flanges in piping 2 1/2" and larger at each connection to all equipment, tanks, and automatic valves.
- C. Locate unions for easy removal of equipment, tank, or valve.

2.9 PIPE HANGERS AND SUPPORTS

- A. Provide adequate supports, hangers, guides, thrusters, etc. as necessary to allow for proper movement of the piping at the building seismic joints and at the thermal expansion loops and flexible connectors, taking into account the pipe size, flex connection type, required seismic movement and system operating temperature and pressure.
- B. Acceptable manufacturers: B-line, Tolco, Superstrut, Unistrut, or approved equal.
- C. All copper pipe shall be isolated from steel hangers and supports using factory Vibra-Cushion strip or plastic coated hangers. Field wrapping of pipe with tape is not acceptable.
- D. Plumbers tape or sheetmetal straps shall not be used for hanging or supporting of pipes.
- E. Support horizontal piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)						Hanger Rod Diameter (inches)		
	Steel	Cast Iron	Copper	Plastic			Steel / Cast Iron	Copper	Plastic
				CPVC	PVC	PP			
Up to 1	7	-	5	3.5	3	2.75	3/8	3/8	3/8
1 1/4	9	-	6	3.5	3	2.75	3/8	3/8	3/8
1 1/2 & 2	9	5	8	3.5	3.5	2.75	3/8	3/8	3/8
2 1/2	12	5	8	3.5	3.5	3.5	1/2	1/2	1/2
3	12	5	10	3.5	3.5	3.5	1/2	1/2	1/2
3 1/2	-	5	10	-	-	-	5/8	1/2	-
4	12	5	10	4	4	4	5/8	5/8	5/8
5	12	5	10	4	4	4	5/8	5/8	5/8
6	12	5	10	4	4	4	3/4	3/4	3/4
8 to 12	12	5	10	4	4	4	7/8	3/4	7/8

F. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

G. Support Steel piping on the roof in accordance with the following schedule:

Nominal Pipe Size (inches)	Spacing of Supports (feet)
1/2	6
3/4 or 1	8
1 1/4 or larger	10
1 1/4 or larger (Vertical)	Every floor level

For pipes on roof other than steel pipe, match support spacing from previous Hanger table above.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural gas piping according to NFPA 54 to determine that natural gas utilization devices are turned off in piping section affected.

3.2 PIPE SIZES TO EQUIPMENT

- A. Pipe sizes indicated, including required valving, shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within 1'-0" of equipment.

3.3 PIPING GENERAL INSTALLATION

- A. Thoroughly clean all pipe and maintain in clean condition during construction temporarily capping or plugging ends of pipe when not being worked on.

- B. Cut pipes accurately to measurements established at the site and work into place without springing or undue forcing and out of the way of openings, ductwork, and equipment; ream ends of screwed pipes and tubing to original bore before connecting together.
- C. Protect all piping located over switchboards, electrical machinery, or equipment against condensation. Insulate piping and install sheetmetal pan underneath piping running above electrical equipment and panels.
- D. Where changes in pipe size occur, use only reducing fittings.
- E. Provide screwed unions or flanges in locations required for disconnecting and connecting of all equipment.
- F. Pipe runs in masonry and concrete floors shall be sleeved for protection.
- G. Chase or sleeve all lines rising in footings and where running concealed through walls.
- H. Caulk space between pipes and sleeves in exterior walls and in concrete slabs with graphite packing and waterproof plastic compound; caulk with Dow Corning #3 6548 Silicone RTV Foam per manufacturer's recommendations at fire walls.
- I. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area. Grout in all other lines.
- J. Support piping where necessary at sufficiently close intervals (and 24" from each fitting and change of direction) to keep it in alignment and to prevent sagging.
- K. Anchor vertical risers with hooks, brackets, or clamps to make rigid.
- L. All changes of direction of piping shall be made with fittings. Do not bend pipe.
- M. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12" from pipes.
- N. Insulate cold water piping outdoors for freeze protection.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 2. Bevel plain ends of steel pipe.
 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints:
 1. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints:
 1. Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints:
 1. Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.5 WASTE, VENT AND CONDENSATE DRAIN PIPING INSTALLATION

- A. Lay piping in straight lines at a minimum slope of 2 percent in direction of flow of drainage system, unless otherwise noted on the Drawings.
- B. Keep stopper in mouth of pipe when pipe laying is not in process.
- C. Make changes in direction with long sweep or bends. Do not change direction of flow more than 90 degrees.
- D. Reducing size of drainage piping in direction of flow is prohibited.
- E. Make connections of branches to mains with "Y" fittings and 1/8 or 1/16 bends.
- F. Install traps and fresh air inlets where required by code regulations.
- G. Install traps with offset drain where required to meet ADA clearances.
- H. Install trap primers discharge piping appropriate for trap primers installed. Coordinate discharge piping routing and method of connection to inlet side of floor drain and ensure discharge piping has positive drainage towards connection point floor drain. Slope piping at 1/8" per foot.
- I. Install cleanouts at ends of horizontal runs in excess of 5'-0" and every 100'-0" of horizontal run.
- J. Makeup cleanout plugs with graphite and oil to facilitate easy removal.

- K. Extend vents through roof. Vents may be combined in accordance with California Plumbing Code. Arrange piping passing through roofs to be a minimum of 12 inches from walls or other obstructions so as to permit proper flashing.
- L. Do not terminate vent outlet less than ten (10) feet from air intakes.
- M. Deliver to the owner at completion of work two (2) suitable wrenches for each type of cleanout installed.
- N. Take necessary precautions to protect cleanouts during course of construction.
- O. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.6 WATER PIPING INSTALLATION

- A. Extend piping for hot and cold water, including mains, risers, and supplies to fixtures and indicated equipment. Carry headers for groups of fixtures full size throughout their length.
- B. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.
- C. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.
- D. Insulate all domestic hot and hot water return piping and fittings.
- E. Make changes in pipe sizes with reducing tees or reducer fittings.
- F. Install a shut off valve at domestic water line to each fixture group so that each group can be shut off without shutting down the other parts of the system.
- G. Provide shut off valves for all plumbing equipment, fixtures, and fixture trim which do not have supply stop or integral isolation valves included.
- H. Arrange and orientate valves, trap primers, water hammer arrestors, etc. in manner accessible for maintenance and/or removal.
- I. No water piping will be permitted below slab on grade unless shown on Drawings.
- J. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Support exposed piping tight to wall with support channels and pipe clamps. All pipe clamps shall include rubber cushion.
- B. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.

- E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.
- G. Adjust hangers to distribute loads equally on attachments.
- H. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

3.8 EXCAVATION AND BACKFILL

- A. Provide excavation for the work of this Division. Excavate all material encountered, to the depths indicated on the Drawings or as required. Remove excavated materials not required or suitable for backfill from the site. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water that accumulates. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- A. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length.
- B. Bedding shall be on minimum 6" deep layer of sand placed on leveled trench bottom. Sand removed to necessary depth for piping bells and couplings to maintain contact of pipe on sand for entire length. All other piping laid on smooth level trench bottom to maintain contact for entire length.
- C. All backfill shall be bank run sand and/or gravel to 6" above piping up to slab on interior piping below slabs. All backfill placed in layers not exceeding 8" deep and compacted to 95% maximum density at optimum moisture content per AASHTO Standards.
- D. Following backfilling, grade all trenches to level of surrounding subgrade. All excess soil shall be located per Owner's instructions.
- E. Do not backfill trenches until all required tests have been performed and the installation observed by the Architect.
- F. After backfilling, remove all surplus earth resulting from this work from the premises and dispose off site.

3.9 PAINTING

- A. Paint exposed piping, valves, service regulators, and piping specialties except components with factory-applied paint or protective coating.
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
- C. Refer to Division 09 for additional painting requirements.

3.10 TESTING, ADJUSTING, AND CLEANING

- A. Provide testing of all installed domestic water, drainage and vent systems during progress of work. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.
- B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.
- C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.
- D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.
- E. Waste and Condensate Drain Piping: All waste and condensate drain systems shall be tested hydraulically by filling to the highest vent point with water. Piping may be tested in sections. Each section of drainage piping tested shall have all openings tightly closed with screw plugs, or equal device, and stand without loss of level for a period of 4 hours when filled with water which produces at least a 10-foot head at the highest point of the section tested.
- F. Water Piping: All water piping shall be tested to 100 psig with potable water and held for 8 hours without drop in pressure before it is covered and concealed. Equipment and personnel shall be protected from this test pressure. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.
- G. Adjust and regulate all faucets, valves, water heating equipment, etc. and turn over to the Owner in perfect working order.
- H. Upon completion of work, clean all equipment and piping installed under this Section.

3.11 DISINFECTION

- A. Upon completion of all tests and necessary replacements, all domestic water piping shall be disinfected. Chlorination shall be accomplished by personnel in direct employ of a firm licensed to do this type of work. After work has been accomplished, provide the Owner and Architect with a statement from the laboratory indicating the water is suitable for human consumption.
- B. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute.
- C. Comply with local requirements where local code requirements are more stringent. Provide necessary labor, equipment, material, and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination tests and tests of proper disinfection.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- D. Sterilize all parts of building water system with water solution containing 50 ppm of available chlorine for at least a 24 hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.
- E. Flush thoroughly and submit bacteriological samples to a certified laboratory which shall certify in writing that the water is suitable for drinking.

3.12 TRAINING AND O&MS

- A. Refer to Section 22 00 00 Plumbing General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION

SECTION 23 00 00

MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

- A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.
- B. Consult all other Sections to determine the extent of this work specified elsewhere.
- C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

- A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:
 - 1. California Building Code
 - 2. California Electrical Code
 - 3. California Plumbing Code
 - 4. California Mechanical Code
 - 5. California Energy Code
 - 6. California Green Buildings Standard
 - 7. California Fire Code
 - 8. National Fire Protection Association

1.4 QUALITY ASSURANCE

- A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner's insurance underwriter.
- B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.
- D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.
- F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

- A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities within Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

- A. Secure and pay for all permits, licenses, inspections, and fees required.
- B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

- A. See Division 09 for painting.

1.8 COORDINATION

- A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.
- B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.
- C. Coordination meetings shall happen within the first two weeks of construction start. Coordination meeting minutes shall be submitted to the Architect for review.

- D. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.
- E. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.
- F. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.
- G. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- B. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.
- C. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.
- D. Furnish all materials and equipment of the same type by the same manufacturer.
- E. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

- A. No substitute materials or equipment may be installed without the written approval of the Architect.
- B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.
- C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.
- D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

- A. Submit shop drawings, manufacturer's data, samples and test reports as specified.
- B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.
- D. Items indicated in submittal comments shall be provided and installed by contractor.
- E. The Engineer and/or Architect shall review the submitted documents for general conformance with the design concept of the project. The review does not relieve the Contractor of the responsibility of deviations from the requirements stated in the contract documents.
- F. The Engineer's and/or Architect's review shall not be construed as a completed detailed check of the work submitted, nor shall it relieve the Manufacturer or Contractor of responsibility for errors or omissions of any sort or from the necessity of furnishing any work required by the contract documents.
- G. Submittals are not reviewed for quantities, dimensions, weights, fabrication processes, construction methods, coordination with work of other trades, construction safety practices, service clearance, location of control and electrical panels, and other layout constraints. These items shall remain the sole responsibility of the Contractor.
- H. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.
- I. Submittals will be returned to indicate appropriate action taken as follows:
 - 1. No Exceptions Taken.
 - 2. Make Corrections Noted. No Resubmittal Required.
 - 3. Revise and Resubmit.
 - 4. Rejected.
 - 5. Not Reviewed.
- J. Use electronic form acceptable to Architect for electronic submittals, containing the following information:
 - 1. Project name.
 - 2. Date.
 - 3. Name and address of Architect and Engineer.
 - 4. Name of Owner.

5. Name, address and contact information of Contractor.
 6. Names and contact information of sub-contractor, manufacturer, and supplier.
 7. Name of entity that prepared submittal.
 8. Category and type of submittal.
 9. Specification Section number and title.
 10. Drawing number and detail references, as appropriate.
 11. Transmittal number, numbered consecutively and revision number clearly identified.
 12. Each item submitted labeled or identified the same as on the drawings.
- K. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.
- L. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.
- M. Provide a bookmark for each submittal section. Include a table of contents at beginning of submittal.
- N. Submit all items related to specification section in single submittal file. Partial submittals will be deemed incomplete and not reviewed.
- O. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.
- P. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

2.4 REQUEST FOR INFORMATION

- A. While every effort has been made to coordinate the locations of equipment covered under other sections or divisions of these specifications, it is the responsibility of the Contractor to coordinate the exact requirements governed by actual job conditions. Check all information and report any discrepancies before submitting bid or fabricating work.
- B. Report discrepancies in time to avoid unnecessary work, and make changes as directed by the Architect.
- C. Do not make changes or additions that are subject to additional compensation without written authorization, based upon an agreed price. Any changes made without the above-mentioned authorization shall be at Contractor's own risk and expense.
- D. Follow manufacturer's instructions where they cover points not specifically indicated. However, if they are in conflicts with these drawings and specifications, obtain clarifications from the Architect before starting work.
- E. All requests for information shall be accompanied with Contractor's proposed solution.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

- A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.
- B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

- A. Drawings show general arrangement and location of ductwork, piping, and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of ducts and piping. Field verify all dimensions.
- B. The exact locations of equipment, ducts, piping, and registers shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of ducts, registers, piping, and equipment up to the time of installation without additional cost.
- C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system. This includes any wiring of sensors, switches, etc.
- D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

- A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.
- B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.
- C. Record drawings must include the following as a minimum:
 - 1. Actual equipment locations.
 - 2. Revisions or substitutions to equipment schedules.
 - 3. Duct/pipe size and routing.
 - 4. Dimensional changes to drawings.

5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.
9. Controls sequence of operations.

3.4 PROTECTION OF BUILDING

- A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

- A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.
- B. Provide proper protection and storage of all items and tools required.
- C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.
- B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.
- C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.
- D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.
- E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.7 QUALITY OF WORK

- A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

- B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 CUTTING AND PATCHING

- A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.
- B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping, or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.
- C. All core drilling, bolt anchor insertion, or cutting of existing structural concrete shall be approved prior to execution of any construction. At all structural concrete to be drilled, cut or bolt anchors inserted, the contractor shall find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts, cores, or bolt anchor locations for approval.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.
- E. Provide sleeves for all ductwork and piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and ductwork or piping. When ductwork or piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

3.9 ACCESS

- A. Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.
- B. No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.
- C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.
- D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.
- E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.10 SEISMIC RESTRAINTS

- A. All equipment, ductwork, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.

3.11 MANUFACTURER'S DIRECTIONS

- A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.
- B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.
- C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.12 BELT DRIVES

- A. Belt drives for fans and equipment shall consist of "V" belts and sheaves.
- B. Drives that require not more than two belts shall be provided with variable pitch, driving sheaves to provide some speed adjustment above and below the normal required operating speed; the adjustments to be as near equal as practicable.
- C. Belts shall be furnished in matching sets.
- D. Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost the Owner.

3.13 ELECTRICAL MOTORS FOR HVAC EQUIPMENT

- A. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified equipment.
- B. Motors and motor control equipment shall conform to NEMA standards and shall be UL listed.
- C. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the in-rush current characteristics of the motor with the motor starter selection, so that all items furnished constitute a complete motor control and protection package. Motor shall not operate in the 15% service factor range.
- D. Motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design.
- E. Motors used with variable frequency drives shall be designed specifically for use on AC inverter power and adjustable speed applications.

- F. Each motor shall be factory-wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point of field power connection under Division 26.
- G. Motors 1/2 HP and smaller shall be rated 120 VAC – single phase – 60 hertz and shall be provided with integral thermal overload protection, unless otherwise indicated.
- H. Motors 3/4 HP and larger shall be rated for 208 VAC or 460 VAC – 3 phase – 60 hertz, unless otherwise indicated.

3.14 COORDINATION WITH ELECTRICAL CONTRACTOR

- A. Coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Provide copies of submittal and installation data to Electrical Contractor for all items requiring electrical connection.
- B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in Division 26.
- C. Electrical Contractor shall furnish disconnect switches, motor starters, conduit and wiring for line voltage power to the equipment. See Division 26 and Drawings.

3.15 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

- A. Do not install piping, equipment, or ductwork, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.
- B. Do not install piping, equipment, or ductwork within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.16 LUBRICATION

- A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.
- B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.17 EQUIPMENT GUARDS

- A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts or machinery. Provide access openings for greasing, oiling, adjusting, etc. All guards shall comply with OSHA requirements and applicable codes.

3.18 CATHODIC PROTECTION

- A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.19 PIPING AND EQUIPMENT IDENTIFICATION

- A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.
- B. Label each thermostat and switch with equipment connected to the thermostat or switch with black lettering on white background.
- C. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.
- D. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.20 GUARANTEE

- A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.
- B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.21 TESTING

- A. Test all ductwork, equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.22 OPENINGS

- A. Locating and sizing of all openings for ductwork and piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.23 CLEAN-UP

- A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.
- B. Clean all work installed under this Contract to satisfaction of Owner.
- C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

3.24 PUNCH LIST

- A. Respond to Architect's punch list in writing within 10 days of receipt. Include action plan and an estimated timeline for completion.
- B. Submit photographs of completed items.

3.25 ACCEPTANCE TESTING

- A. Equipment and systems requiring acceptance testing certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See Drawings for equipment and systems requiring acceptance certification. Tests shall be performed by Certified Mechanical Acceptance Test Technician. Contractor shall be responsible for procuring the required test forms from the California Energy Commission website.
- B. The acceptance testing procedures must be repeated, and deficiencies must be corrected by the contractor until the construction/installation of the specified systems conform and pass the required acceptance criteria.

3.26 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

- A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.
- B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.
- C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.27 OPERATING AND MAINTENANCE MANUALS

- A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.
- B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.
 2. Identifying equipment manufacturer, product name, and model number.
 3. Locations.
 4. Wiring Diagrams.
 5. Lubrication Charts.
 6. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.
 7. Assembly and disassembly instructions.
 8. Startup procedures.
 9. Routine and normal operating instructions.
 10. Normal and emergency shutdown instructions.
 11. Troubleshooting diagnostic instructions.
 12. Parts list and recommended spare parts including name and address of source of supply.
- C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.
- D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.
- E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 23 05 00

HEATING, VENTILATING, AIR CONDITIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, and services to furnish and install complete mechanical systems which shall include, but not limited to equipment, ductwork, piping, accessories, insulation, and supports.

1.3 SUBMITTALS

- A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:
 - 1. Split Systems.
 - 2. Fans.
 - 3. Roof Hoods and Caps.
 - 4. Ductwork.
 - 5. Duct Insulation and Lining.
 - 6. Dampers and Duct Accessories.
 - 7. Filters.
 - 8. Diffusers, Registers, and Grilles.
 - 9. Louvers.
 - 10. Refrigerant Piping.
 - 11. Mechanical Supports.
 - 12. Controls.
 - 13. Coordination Drawings: plans and details, drawn to scale, on which equipment and duct routing is shown and coordinated with other installations, using input from installers of the items involved.
- B. No substitute materials or equipment shall be installed without the written approval of the Architect.
- C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.
- D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

PART 2 – PRODUCTS

2.1 HVAC EQUIPMENT

- A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

2.2 FILTERS

- A. Filters shall be 2"-thick of size and number required for equipment and selected for 300 FPM velocity.
- B. Filters shall be throwaway type, Class 2 UL listed.
- C. Filters shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method.

2.3 ROOF HOODS AND CAPS

- A. Roof hoods shall be of size, type, and capacity noted on Drawings.
- B. Roof caps for exhaust shall be of size required for duct dimensions noted on Drawings.
- C. Roof hood and cap housing shall be constructed of heavy gauge galvanized steel and shall be fully weatherproof and painted with name. Cap and hood shall be reinforced to prevent oil canning and deflecting in high winds. Roof caps and hoods shall be complete with bird screen and roof curb. Distance of hood from roof shall be 18" unless otherwise noted on Drawings.

2.4 DUCTWORK

- A. Comply with latest edition of SMACNA HVAC Duct Construction Standards, Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Comply with NFPA 90A when ducts traverse through smoke zones.
- B. Comply with UL 181 and California Energy Code Section 120.4 requirements for air distribution ducts and plenums.
- C. Ducts shall be minimum 24 gauge thickness. Ducts shall be constructed for 2500 FPM maximum velocity and static pressure classes as follows:
 - 1. Supply Ducts: +3 inch w.g.
 - 2. Return Ducts: - 2 inch w.g.
 - 3. Exhaust Ducts: -2 inch w.g.
- D. Longitudinal seams: Groove and Pittsburgh lock seams and slip joints shall be used.
- E. Duct Connections: Ductmate industries "Ductmate 35" and "Ductmate 45". Ductmate "Spiralmate" for round duct. Ductmate "Ovalmate" for oval duct.
- F. Duct sealing shall be DP 1010 water based duct sealant or other equal and SMACNA approved foil-backed pressure sensitive tape or other equal.

- G. Flexible ducts shall be UL 181 and Class I air duct in compliance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, and NFPA 90A and 90B.
- H. Flexible ducts shall be two-ply vinyl film supported by helically wound spring-steel wire, R4.2 fiberglass insulation, exterior reinforced laminated vapor barrier film. Duct shall be rated for +2 inch w.g., -1 inch w.g., 4000 FPM maximum velocity, and -10°F to +160°F. Flame Spread less than 25, Smoke Developed less than 50.

2.5 DUCT INSULATION AND LINING

- A. All duct insulation and lining shall comply with California Energy Code Section 120.4 requirements for air distribution ducts and plenums.
- B. Insulation shall conform to NFPA 90A and 90B, and UL 181, Class I. Insulation shall have Flame Spread not over 25 and Smoke Developed of not over 50.
- C. Wherever external duct insulation is specified and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specification for the same location, the external insulation may be omitted.
- D. Acceptable Manufacturers: Johns Manville, Owens Corning or approved equal.
- E. Acoustic Duct Liner: 1" thick, R4.2 in directly conditioned space and 2" thick, R8.0 in unconditioned space or outdoors. Owens Corning Quiet R, or approved equal.
- F. Duct Insulation: 3" thick, R8.3 in unconditioned space and 1 1/2" thick, R4.2 for indirectly conditioned space. Owens Corning SoftR Ductwrap FRK, or approved equal.
- G. Duct Insulation Outdoor: 2" thick rigid board fiberglass, R8.7 with 0.016 inch thick sheet Aluminum jacket.

2.6 REGISTERS, DIFFUSERS AND GRILLES

- A. Acceptable manufacturers: Titus, Krueger.
- B. Registers, diffusers, and grilles shall be as indicated on Drawings. Drawings and schedules indicate specific requirements of air inlets and air outlets. Other manufacturers' products with equal quality, appearance, finish, and performance characteristics may be considered.
- C. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required.
- D. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling type and construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.
- E. Registers, diffusers, and grilles in fire-rated ceilings or walls shall be all-steel construction.

2.7 DAMPERS AND DUCT ACCESSORIES

- A. Acceptable manufacturers:
 - 1. Dampers: Ruskin, Air Balance Inc, Pottorff, or approved equal.

2. Actuators: Belimo, Honweywell, or approved equal.
 3. Turning vanes: Ductmate industries, Duro Dyne, or approved equal.
 4. Flexible connectors: Duro Dyne, Ventafabrics, or approved equal.
 5. Duct access doors: Ductmate industries, Ward industries, or approved equal.
 6. Backdraft dampers: Ruskin, Greenheck, Air Balance Inc, or approved equal.
 7. Fire dampers: C&S Air products, or approved equal.
- B. Provide volume dampers as specified or shown on the Drawings for proper balancing and distribution of air. Provide single blade dampers in ducts 24 inches in width or less, or 12 inches in height or less. Provide multiple blade, opposed blade design, dampers for all other duct sizes. Coordinate with the balancing contractor and provide additional dampers required for proper air balance.
- C. Dampers shall be galvanized steel construction and shall be minimum 2 gauges thicker than duct gauge. Damper shall be pivoted to turn easily, provided with operating handles and locking devices mounted on the outside of the duct in an accessible location. Dampers shall be reinforced for rigidity.
- D. Control dampers for outside air and return air shall be low-leakage with blade edge seals and jamb seals. Damper shall be AMCA licensed as a Class 1A damper.
- E. Damper actuators for control dampers shall be modulating, 24V power supply, 0-10V DC control input, weatherproof construction.
- F. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards, Metal and Flexible for vanes and vane runners. Vane runners shall automatically align vanes.
- G. Manufactured Turning Vanes: Fabricate 1 1/2" wide, double vane, curved blades of galvanized steel construction set to 3/4" o.c. Support with bars perpendicular to blades set 2" o.c. and set into vane runners suitable for duct mounting.
- H. Flexible duct connectors shall be flame retardant fabrics, coatings, and adhesives complying with UL 181, Class I. Where exposed to weather, fabric shall be double coated with weatherproof, synthetic rubber resistant to UV rays.
- I. Duct access doors shall be airtight and suitable for duct pressure class, constructed of galvanized steel with insulation fill as integral part of appropriate thickness. Include cam latches, sash locks, and hinges such that doors can easily be opened without tools. Seal around frame with neoprene or foam rubber.
- J. Backdraft dampers shall be multi blade, parallel action gravity balanced, or adjustable counter-balance weighted dampers. Dampers shall have center pivoted blades of maximum 6" width, with sealed edges, assembled in rattle free manner with 90-degree stop. Provide with adjustment device to permit setting for varying differential static pressure.
- K. Fire dampers shall be UL listed and conforming to NFPA 90A. Dampers shall be factory installed in sleeves. Dampers shall be arranged to close automatically upon operation of listed fusible link.

2.8 REFRIGERANT PIPING

- A. Refrigerant line kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed. Factory insulated lines with flared fittings at both ends. Mueller Streamline Co., JMF Company, or approved equal.
- B. Refrigerant pipe insulation shall be flexible closed cell elastomeric foam complying with ASTM C534 with UV retardant, and resistant to mold and mildew.
- C. Both suction and liquid lines shall be insulated outdoors and in exposed indoor locations. Concealed Indoor liquid lines may omit insulation for cooling only units.
- D. Outdoor piping shall have insulation covered with .016 inch thick aluminum jacket.
- E. Indoor exposed piping shall have insulation covered with smooth PVC jacketing, painted per Architect's directions.
- F. Refrigerant pipe insulation shall meet requirements of California Energy Code Section 120.3.

2.9 HANGERS AND SUPPORTS

- A. Subject to compliance with requirements, provide products by one of the following manufacturers or other approved equal:
 - 1. B-Line.
 - 2. Mason West.
 - 3. Unistrut.
 - 4. Power Strut.
 - 5. Hilti.
- B. Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code. Comply with AWS D1.1 procedures for field welding.
- C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.10 SLEEVES

- A. Construct sleeves for pipes passing through walls, floors, partitions, hung or furred ceilings, etc. of minimum 18 gage galvanized steel, flanges on each side of wall, partition, hung or furred ceiling, etc.
- B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.
- C. Provide 20 gage galvanized sheet metal sleeves for round ductwork passing through masonry or concrete construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.
- D. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations.

2.11 CONTROLS

- A. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.
- B. If indicated on Drawings, provide thermostats by specified manufacturer.
- C. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.
- D. Mount thermostats 48 inches above finished floor.
- E. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces, including mechanical rooms, shall be in conduit and in accordance with Division 26. Wiring concealed above ceiling shall be plenum rated cable complying with NFPA 70.
- F. Provide and install heavy duty lockable thermostat cover for assembly areas, gymnasiums, and any other public areas required by Owner.

2.12 PAINTING

- A. See Division 09 for painting.
- B. Prime and paint diffuser boot and duct interiors where visible through grilles with a matte black finish.
- C. Prime and paint exposed ductwork, supports, and registers where required by the Architect.
- D. Prime and paint louver or grille interiors where required by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation clearances, tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Equipment shall be installed level, on curbs or supports as required and/or indicated on Drawings and in accordance with manufacturer's instructions and recommendations.
- B. Equipment shall be installed in locations shown and as complete assemblies with adequate service clearances for access and maintenance as required by codes and equipment installation manuals.

3.3 DUCTWORK INSTALLATION

- A. All ductwork gauges, joints, reinforcing, and other details shall be in accordance with latest edition of SMACNA manuals unless otherwise specified.

- B. Duct dimensions are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.
- C. Provide minimum 24-gauge sheet metal construction for ducts. Construct ducts with NFPA 90A gauges when traversing smoke zones.
- D. Construct ducts of galvanized sheet metal, except where otherwise indicated or specified.
- E. Construct all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of travel.
- F. Construct all ductwork to avoid sharp duct edges. Edges shall be sufficiently rounded and where not possible, sharp edges shall be covered with edge protectors.
- G. Fabricate changes in direction, both horizontal and vertical, to permit easy airflow.
- H. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.
- I. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing, etc. insert through air-tight rubber grommets.
- J. Provide pitot tube openings where required for testing of systems. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage. Coordinate locations of openings with balancing contractor.
- K. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear. Install exposed ducts as high as possible. Coordinate with other trades to maintain minimum 7'-6" clearance above finished floor, unless otherwise indicated.
- L. Install ducts unless otherwise indicated, vertically or horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- M. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.
- N. Install dampers in branch duct for all air inlets and outlets at accessible location. Dampers shall be capable of adjustments and of being locked into position.
- O. Use radius elbows in rectangular ductwork unless otherwise indicated. Centerline radius shall be a minimum 150 percent of duct width. Where space does not permit duct radius, install square elbow with turning vanes.
- P. Ends of ducts shall turn over 3/4" for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.
- Q. All ducts shall be supported per SMACNA HVAC Duct Construction Standards. Supports and seismic bracing shall be in accordance with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.
- R. Ducts exposed to weather shall be completely waterproof with outdoor vapor barrier mastic over tape at all joints and seams. Slope entire top of duct down towards sides and coordinate duct slope with roof slope. Arrange standing seam, joints, and flanges to prevent accumulation, ponding or pooling of water.

- S. Seal joints and seams of ductwork airtight to SMACNA seal classifications.
- T. Protect all ductwork and interiors of ducts shall be clean and free from foreign materials until building is enclosed.
- U. All ductwork and sealing shall comply with California Energy Code Section 120.4 requirements for Air Distribution System Ducts and Plenums.

3.4 DUCT SEALING

- A. Duct systems shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler air flow rate.
- B. Ductwork for constant volume systems that have more than 25 percent of the total duct surface area located outdoors or in unconditioned space shall have the duct leakage confirmed through HERS field verification and diagnostic testing.
- C. New duct systems not subject to testing shall meet duct leakage requirements of CMC 603.9.2.

3.5 FLEXIBLE DUCTWORK INSTALLATION

- A. Flexible ductwork shall be installed with no runs of more than 5'-0" in length and shall be used only at register connections.
- B. Flexible duct shall be installed in fully extended condition, free of sags and kinks, using only minimum length required to make connection. Bends greater than 90° are not allowed.
- C. Flexible duct shall be full size of branch. Any change in size to match terminal connection shall be made at terminal. Connect to duct collars, terminal unit connections and air inlets and outlets per manufacturer's instructions.
- D. All connections shall be sealed with high pressure duct sealer and secured with 3/8" nylon straps around inside liner of flexible duct.
- E. Flexible ducts shall be supported at or near mid-length with 2" wide, 28 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

3.6 DUCT INSULATION AND LINING INSTALLATION

- A. Concealed ductwork shall be insulated with fiberglass ductwrap.
- B. Provide acoustic lining where indicated on Drawings.
- C. All supply and return ductwork shall be insulated, or acoustically lined on the inside when ductwork is exposed.
- D. Exhaust duct need not be insulated. Outside air duct indoors need not be insulated. Outside air duct installed outdoors shall be insulated.

3.7 DUCT ACCESSORIES INSTALLATION

- A. Flexible connections shall be installed on inlet and outlet duct connections of fans, air conditioning units, furnaces, and all other HVAC equipment. Fabric shall be of weight and strength for service required, properly fitted to render connection airtight. Fabric of sufficient width to provide minimum 4" between connected items.
- B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Install backdraft dampers at roof hoods or louvers connected to ductwork.
- C. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units. Access doors shall be large enough for maintenance.

3.8 FILTER INSTALLATION

- A. Filter boxes shall have hinged access panels and shall allow tool-less entry.
- B. Filter boxes shall be installed such that they are easily accessible and allow unimpeded removal and installation of filters without interference with other obstacles.
- C. Filter boxes shall accommodate 2" thick filter installation.
- D. Filter boxes shall be installed with air tight seals and the access door shall fully close with a seal to prevent infiltration of air.

3.9 REGISTERS, DIFFUSERS, AND GRILLES INSTALLATION

- A. Locations indicated on the Architectural Drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- B. Install with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.
- D. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions.
- E. All visible interior surfaces of registers, diffusers, and grilles shall be painted flat black.
- F. All visible exterior surfaces of registers, diffusers, and grilles shall be factory off-white finish as standard. Where required by Architect, provide in a color as selected by Architect or provide prime-painted for field painting.

3.10 REFRIGERANT PIPING INSTALLATION

- A. Refrigerant pipe installation shall comply with latest editions of ASHRAE 15 and ASME B31.5.
- B. Install piping in accordance with manufacturer's instructions and good practices.

- C. Install piping adjacent to unit to allow access to unit for service and maintenance.
- D. Where required, provide or install additional refrigerant charge per equipment manufacturer's requirements. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- E. Install piping as short and direct as possible, with a minimum number of joints and fittings.
- F. Support exposed piping tight to wall with strut channels and pipe clamps. Support concealed pipe on hanging pipe supports, provide bracing where required.
- G. Support roof piping at sufficient intervals to prevent pipe sag.
- H. Route piping in orderly manner, parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Install piping to conserve space and avoid interference with use of space.
- I. Install piping in straight lines and use 45 degree or 90 degree bends for changes in direction.
- J. Slope piping one percent in direction of oil return. Provide suction traps at base of suction risers where required.
- K. Piping shall be cut accurately to measurements established at job site and worked into place without springing or forcing, allowing for proper head room.
- L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- M. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.
- N. Install insulation without any gaps or cracks and use contact adhesive recommended by manufacturer at joints and connections.
- O. When the thickness of insulation is reduced, for example at support hangers, reinforce the reduced thickness with additional insulation.
- P. Seal longitudinal seams and end joints of insulation with manufacturer's recommended adhesive to eliminate openings in insulation. Installation to maintain a continuous vapor barrier.
- Q. Where metal jackets are indicated for insulation, install with 2 inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center at end joints.
- R. Use insulated pipe clamps and insulated pipe supports to provide continuous insulation throughout. No section of bare pipe shall come in contact with other metals.
- S. Brazed joints: Construct joints according to AWS C3.4M/C3.4.
 - 1. Provide brazing for refrigerant piping system using AWS A5.8/A5.8M, Bag-1 with 15 percent silver, 80 percent copper and 5 percent phosphorous.

2. Clean surfaces to be jointed of oil, grease, rusts, and oxides.
3. Any joints showing evidence of overheating, cracking, poor penetration, or other defects of fit-up or workmanship shall be replaced as directed by the Architect at the contractor's expense.

3.11 LOUVERS INSTALLATION

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Comply with SMACNA's Architectural Sheet Metal Manual for fabrication, construction details, and installation procedures.
- D. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- E. Use concealed anchorages where possible.
- F. Form closely fitted joints with exposed connections accurately located and secured.
- G. Protect unpainted galvanized and nonferrous metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses where watertight louver joints are required.

3.12 HANGERS AND SUPPORTS INSTALLATION

- A. All equipment, plenums, registers, ductwork, and piping shall be securely anchored to building structure and seismically braced as required by the Drawings and Specifications. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0295-13 and OPM-0052-13, and the California Building Code.
- B. Comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible for hanger rod or sheet metal strap sizes and spacing for duct supports.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install hangers and supports to provide indicated pipe slopes.

- H. Adjust hangers to distribute loads equally on attachments.
- I. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.
- J. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding.

3.13 TESTING

- A. Comply with more stringent of system manufacturer's requirements and requirement indicated herein.
- B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.
- C. After completion of refrigerant piping installation, pressurize piping systems to a test pressure of not less than 600 psig using dry nitrogen.
 - a. Test field piping to 600 psig pressure in increments of 200 psig.
 - b. Test pressure for low side of the system shall be maximum low side allowable pressure.
 - c. Test pressure for high side of the system shall be maximum high side allowable pressure.
 - d. If the high side of the system cannot be isolated from the low side of the system, the entire system shall be pressure tested to the low side maximum allowable pressure.
- D. Successful testing shall maintain the test pressure for a continuous and uninterrupted period of 24 hours.
- E. After completion of pressure testing evacuate piping systems using a vacuum pump with a check valve. Maintain test pressure per manufacturer's requirements for a continuous and uninterrupted period of one (1) hour.
- F. Prepare and submit test reports to the Architect for project record.
- G. Charge the refrigerant piping system following system manufacturer's written instructions. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.14 ADJUSTING

- A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature setpoints. Adjust initial airflow settings and discharge airflow patterns.
- C. Set field adjustable switches and circuit breaker trip ranges according to manufacturer's written instructions.

3.15 FIELD QUALITY CONTROL

- A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Provide a written report of inspection to the Architect.
- B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.

3.16 TRAINING AND O&MS

- A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Test and balance air distribution systems.

1.3 QUALITY ASSURANCE

- A. Work shall be performed by independent testing agency certified by AABC or NEBB. Work shall be performed by qualified technicians and trained personnel, using instruments certified accurate to its limits.
- B. Use standard forms from AABC's National Standards for Testing, Adjusting and Balancing or NEBB's Procedural Standards for Testing, Adjusting and Balancing.
- C. Calibrate instruments at least every twelve months or more frequently if required by the instrument manufacturer.

1.4 COORDINATION

- A. Coordinate efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist with testing, adjusting, and balancing activities.
- B. Check for and report defects or deficiencies that may affect balancing.
- C. Mechanical Contractor shall advise Balancing Contractor of changes made to the system during construction.
- D. Mechanical Contractor shall install test holes or wells complete with removable and replaceable plugs or caps, dampers as specified on Drawings and where required by Balancing Contractor to obtain final system balance.
- E. Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, or the addition of dampers for the correct balance as recommended by Balancing Contractor at no additional cost to the Owner.
- F. Controls Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls.

1.5 SUBMITTALS

- A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:
 - 1. TAB agency and team member qualifications.
 - 2. Strategies and procedures plan.
 - 3. Sample report forms intended for use on this project.
 - 4. Instrument calibration reports.
- B. Submit final, completed balance report prior to request for final mechanical observation of the project.

PART 2 – PRODUCTS

2.1 INSTRUMENTS

- A. Utilize test instruments and equipment of type, precision, and capacity as recommended in the AABC or NEBB standards.
- B. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Prior to construction, examine the Contract Documents to become familiar with the project requirements and to discover conditions in the systems' designs that may preclude proper testing, adjusting and balancing of systems and equipment.
- B. Examine system and equipment installations to verify that balancing devices are properly installed and accessible for effective balancing.
- C. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.

3.2 GENERAL PROCEDURE

- A. Perform testing and balancing procedures on each system according to procedures contained in AABC or NEBB standards.
- B. Testing and balancing shall not begin until system has been completed and is in full working order.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation or test probes to the minimum extent necessary for balancing procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this project.
- D. Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

- E. Balance to a maximum measured flow deviation from specified values of plus or minus 10 percent at terminal devices and outlets, and plus or minus 5 percent at equipment.
- F. At final inspection, recheck random selections of data recorded in report to verify balance has not been disrupted.

3.3 AIR SYSTEMS PROCEDURE

- A. Execute air systems balancing for each air system in accordance with AABC or NEBB standards and as described herein.
- B. Conduct tests with supply, return and exhaust systems operating and doors and windows closed or in their normal operating condition.
- C. Construction filters shall be removed before testing and balancing. Tests shall be done with final filters installed. Allowances shall be made for air filter resistance at time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.
- D. Test and adjust fan or blower speed to design requirements.
- E. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.
- F. Traverse main supply air ducts, using a pitot tube and manometer.
- G. Submit data in support of fan deliveries by the following methods:
 - 1. By summation of the air quantity readings at inlets or outlets.
 - 2. By duct traverse of main ducts.
- H. Test and record required and measured system static pressures, filter differential, coil differential and fan total static pressure.
- I. Test and adjust systems for design recirculated airflow rates.
- J. Test and adjust system for outside airflow rates. Measure and adjust outside airflow rates for all fan speeds.
- K. Test and record entering and leaving air temperatures in both heating and cooling modes.
- L. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in the correct positions, all duct access doors are closed and fire damper fusible links are accessible.
- M. Adjust zones to proper design supply, return, and exhaust flow rates.
- N. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.
- O. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent short circuiting between supply and return outlets.

- P. Vary total system airflow rates by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- Q. Record installed fan drive assemblies; fans sheaves, motor sheaves, belts and motors.
- R. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.
- S. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.02 inch wg minimum and 0.05 inch wg maximum shall be achieved, measure with negligible outside wind velocity.

3.4 ACCEPTANCE

- A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.
- B. If it is found that specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action.

3.5 BALANCE REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
- B. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB firm and specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Summary of contents including the following:

- a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
- C. Report shall be indexed as follows:
- 1. Air
 - a. Summary.
 - b. Procedure.
 - c. Instrumentation.
 - d. Drawings.
 - e. Equipment Summary.
 - f. Fan Sheets.
 - g. Fan Curves.
 - h. Fan Profile Data.
 - i. Static Data.
 - j. Traverse Data and Schedule.
 - k. Terminal Unit Summary.
 - l. Outlet Data Summary and Schematics (per system).
 - m. Supply Temperature Data.
 - n. Building Pressurization Data.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:

1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications as required for a complete and fully functional system.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including monitoring equipment and wiring for central station connection.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, lamps, dimmers, racks, dimming ballasts/drivers, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. Site work as shown and/or required.
5. Duct banks and raceways for all power and communications systems as shown and/or required. Duct banks shall include all trenching, racking, conduit, concrete, backfill, boxes, pads, substructures required for a fully developed and useable pathway for cables, conductors, as shown on site, etc.
6. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units, etc. Provide protective equipment unless otherwise noted, including protective devices.
7. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required unless provided by mechanical specification.
8. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
9. Data systems infrastructure including all boxes, raceways, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications, EIA/TIA standards and/or required for a complete and operating system.
10. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
11. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

- B. Related Sections Under Other Divisions:
1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
 2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
 3. Irrigation System: Provide all line voltage (50 volts or above) connections to irrigation system equipment, time clocks and or powered satellite controls. Coordinate locations of this work with the Landscape Contractor.
 4. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).

1.3 SYSTEM DESCRIPTION

- A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
- B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

1.4 SUBMITTALS AND SHOP DRAWINGS

- A. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner's representative, will solely be at the contractor's risk.
- B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
1. Site work equipment including ducts, conduits, fittings, concrete manholes, concrete and fiberglass pull, manhole, boxes, vaults, trench racks, accessories, etc.
 2. Distribution equipment including distribution/branch panels breakers, grounding, transient voltage surge suppressors, etc.
 3. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
 4. Lighting equipment including fixtures, ballasts/drivers, lamps, mounting accessories, color charts (where required), etc.
 5. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
 6. Constructability review letter/comments for lighting acceptance testing as required by Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
 7. Complete system component submittals and shop drawings for:

- a. Sound Systems with assisted listening devices as required to meet ADA.
 - b. Fire Alarm System
 - c. Communication Systems including but not limited to: cable, fiber, terminations, cable management, patch panels, equipment racks, specified active electronics (where called for), cabinets, jacks, plates, cable labeling, testing procedure.
8. Conduit including all fittings, etc.
 9. Wiring and cable, terminations, etc.
 10. Fire rating penetration materials, details, etc.
- C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.
- D. SUPPORTING DEVICES
1. Provide all details of suspension and support for ceiling hung equipment.
 2. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points.
 3. Provide seismic details of seismic restraints and anchors; including number, size and locations for each piece of equipment.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.
- B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

2.2 SUPPORTING DEVICES

- A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8" rod with ceiling flange.
- B. Concrete Inserts: Kindorf D-255, cast in concrete for support fasteners for loads up to 800 lbs.
- C. Pipe Straps: Two-hole galvanized or malleable iron.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent apprised of changes or clarifications, etc.
- B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
 - 1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
 - 2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman's valid Pocket Card.
- C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.
- D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.
- E. Supporting Devices:
 - 1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.

2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
 3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
 4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
 5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
 6. Provide seismic bracing per UBC requirements for this building location.
 7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category "SDC" per Structural Engineer.
- F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.
- G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner's review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.
- H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.
- I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.
- L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.
- M. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

END OF SECTION 26 05 00

SECTION 26 05 01 - SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor to walk job to observe existing conditions and account for variance as needed.
- B. Verify field measurements and circuiting arrangements as shown on drawings.
- C. Verify that abandoned wiring and equipment serve only abandoned facilities.
- D. Demolition Drawings are based on limited field observation and existing record documents. Report discrepancies to Owner/Architect before disturbing existing installation.

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Allow the owner first right to retain ownership of salvaged materials, otherwise the Electrical Contractor is responsible for its removal from the site and proper disposal or recycling.
- D. Remove abandoned wiring to source of supply. Existing abandoned conductors removed over #12 AWG shall be salvaged back to the District Maintenance Yard located at 222 Stanley Ave, Arroyo Grande, CA.
- E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Disconnect and remove abandoned panelboards and distribution equipment.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.
- K. Repair adjacent construction and finishes damaged during demolition and extension work.
- L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. 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.
- C. Luminaires: Cleaning light fixtures. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace LED drivers, light fixtures, ballasts and broken electrical parts as required for any inoperative fixtures. Provide new lamps for all fixtures that are to remain.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.5 INSTALLATION

- A. Install relocated materials and equipment as shown and/or as required.

END OF SECTION 26 05 01

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Wires and cables.
 - 2. Connectors.
 - 3. Lugs and pads.

1.3 SYSTEM DESCRIPTION

- A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Provide product data for the following equipment:
 - 1. Wires.
 - 2. Cables.
 - 3. Connectors.
 - 4. Lugs.
 - 5. Splice Kits.
 - 6. Strain Relief Fittings.
 - 7. Cable Racking and Insulators.
- C. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
- B. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.
- B. Connectors: Burndy, IlSCO, Thomas & Betts, or approved equal.
- C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.
- D. Splices:
 - 1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
 - 2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
 - 3. Screw Terminal Lugs.
 - 4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

- A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
- B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.
- C. Color Code Conductors as Follows:

PHASE	208 VOLT
A	Black
B.	Red
C.	Blue
Neutral	White
Ground	Green
- D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other

sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.

- E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
- F. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

2.4 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.
- B. Insulation: Use proper insulation types where temperature and environment are a factor.
- C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer's review and approval prior to commencing with the work.

- D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed brass tags identifying system serviced and function. See Section 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS.
- E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.
- F. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.
- G. Wires and Cables:
 - 1. Conductor Installation:
 - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
 - b. Install conductors with care to avoid damage to insulation.
 - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
 - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
 - 2. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12AWG unless otherwise shown.
 - b. Provide all required conductors for a fully operable system.
 - 3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
 - a. Lighting and power branch circuits.
 - b. Dimmer controlled circuits.
 - c. Isolated ground circuits.
 - d. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
 - e. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
 - 4. Conductors in Cabinets:
 - a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
 - b. Tie and bundle feeder conductors in wireways of panelboards.
 - c. Hold conductors away from sharp metal edges.
 - d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

3.2 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION 26 05 19

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
 - 2. "Grounding electrode system" refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
 - 3. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes smaller than No. 2 AWG shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.2 GROUND RODS

- A. Copperclad steel, 5/8" diameter by 10' long, conforming to UL 467 unless otherwise noted on drawings and details.
- B. Quantity of rods shall be as required to obtain the specified ground resistance or additional rods shall be driven to obtain specified resistance or less.

2.3 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
 - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.

- C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:
 - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 - 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
 - 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to nearest component of the grounding electrode system and the ground bar at the service equipment.
- F. Conduit Systems:
 - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
 - 2. Non metallic conduit systems shall contain an equipment grounding conductor.
 - 3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

- A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS.

3.6 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 25 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.
- D. Furnish a copy of tests to Owner at completion of project.

3.7 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 8' in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.8 GROUNDING FOR RF/EMI CONTROL

- A. Install bonding jumpers to bond all conduit, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4" wide copper strip or two No. 10 copper conductors spaced minimum 4" apart. Use No. 6 copper where exposed and subject to damage.

- B. Comply with the following when shielded cable is used for communication circuits.
1. Shields shall be continuous throughout each circuit.
 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
 3. Do not connect shields from different circuits together.
 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

END OF SECTION 26 05 26

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Cabinets, termination cabinets.
6. Gutters.
7. Concrete boxes and vaults.
8. Fiberglass or composite boxes and vaults.

- B. Related Work:

1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to: power for site utilities and lighting, site and building communications, controls, fire alarm, data system, energy management systems, power distribution, lighting, lighting controls, voice communications, intercom, HVAC and other building low voltage/communications systems controls as may be required.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor's responsibility to ensure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.

7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Conduits shall have minimum cover requirement of 24" below finish grade. More stringent depth requirements may be imposed by the local agency and shall be adhered to, and / or this specification or as detailed on the plans. Joint trenching may be utilized where practicable and where permitted by this specification. Concrete, native material and sand shall be used as backfill material and shall be compacted in accordance with and coordinated with the grading and site preparation requirements. Conduits shall rest in a minimum of 4" bed of sand prior to backfill and compaction. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation.
8. Minimum conduit size shall be 3/4" except if plan shows or code requires larger size. Exception: Use minimum 1" for underslab and below grade applications outside of building exterior walls.
9. All electrical, control, communications systems shall be installed in metallic conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
10. All line voltage wiring within the building shall be installed in metallic conduit.
11. All conduit, concrete pads, underground concrete or fiberglass substructures shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
14. All low voltage systems including intercom, fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 1300, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
15. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
16. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
17. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.
18. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
19. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.

20. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
21. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
22. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.3 SUBMITTALS

- A. Provide Shop Drawings and Product Data for the Following Equipment:
 1. Conduit and fittings.
 2. Outlet boxes.
 3. Weatherproof outlet boxes.
 4. Junction and pull boxes.
 5. Cabinets, termination cabinets.
 6. Gutters.
 7. Concrete boxes and vaults.
 8. Fiberglass or composite boxes and vaults.
 9. Raceways

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
- D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
- E. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards. Aluminum Flexible Metal Conduit will NOT be allowed.

- F. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350. Aluminum Liquid Tight Flexible Metal Conduit will NOT be allowed.
- G. Wire basket tray shall be 12" wide with 4" side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.
- H. Manufacturers:
 - 1. Outlet Boxes: Bowers, Raco, Steel City or equal.
 - 2. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
 - 3. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
 - 4. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
 - 5. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
 - 6. Vaults: Christy, Brooks, Utility Vault or equal.
 - 7. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 - 8. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
 - 9. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
 - 10. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
 - 11. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
 - 12. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liguatite or equal.
 - 13. Wire basket tray, B-line, GS Metals, Cablofil or equal.
 - 14. Exterior In-Grade Boxes for Non-Utility Company, Precast concrete or polymer concrete, Utility Vault and Christy.

2.2 OUTLET BOXES

- A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.
- B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as "MYERS" gasketed type hub.
- C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4" square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal. HDMI boxes shall be 4-11/16" square and all data/communications outlets boxes shall be true 5" square (RANDL Industries or approved equal).
- D. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1 1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

- E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.
- F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.
- G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast iron, with zinc finish, weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, zinc, galvanized finish.
- B. Surface mounted die cast aluminum device boxes shall be provided with screw holes to accommodate cast device covers.
- C. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner. Weatherproof boxes in wet locations as described in CEC 406.8 (B) shall be provided with a "while-in-use" cover. When on-grade, unit to be Midwest #U010010GRP or #U012010GRP or approved equivalent. When on roof, red dot 'CK' Series of aluminum die-cast construction, NEMA 3R, with lacquer finish, or approved equivalent.

2.4 JUNCTION AND PULL BOXES

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
 - 3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24" shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
 - 4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.5 BOX EXTENSION ADAPTER

- A. Construction: Cast iron with gasket.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.6 CONDUIT FITTINGS

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. A bushing shall be required at all conduit terminations into distribution equipment, service equipment and pull boxes/vaults.
- C. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.7 EXTERIOR IN-GRADE BOXES FOR NON-UTILITY COMPANY USE SHALL BE:

- A. Precast concrete or polymer concrete type with full bottoms and draining into gravel drywell. Open bottom splice/pull boxes smaller than 24" x 36" shall be open bottom, with minimum 12" of gravel below for drainage, only if a vault is not already specified on the plans.
- B. Flushmount in hardscape and 1" above grade in softscape.
- C. Provided with correct traffic type lid, i.e., full vehicular, intermediate incidental vehicular or pedestrian-rated as applicable stamped with "ELECTRIC", "LIGHTING", "COMMUNICATIONS", etc. cover identification as shown on the drawings or as applicable. All boxes or vaults located in streets, driveways, sidewalks wider than 8', and turf areas where mowing takes place shall be traffic rated.
- D. Provided with brass hold-down bolts in cover.
- E. Provided with necessary box extensions to gain proper depth.
- F. Seal all conduit in underground boxes with duct seal after conductors have been installed. All conduit penetrations into underground boxes, enclosures and pad mounted equipment shall be provided with bell ends.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention

to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these.

Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8' above finished grade shall be strapped at a minimum of 5' spacing.

- B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4" of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150' in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.
- C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'-0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped. Exposed threads on GRS shall be coated with a cold galvanized paint.
- D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be diecast non-insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.
- E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 20' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings

shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Steel flexible metal conduit shall be limited to areas where conduit must be fished in inaccessible spaces or for interior appliance applications when accessible or exposed.

- F. Underground conduits and transition to above grade/slab shall be as follows:
1. PVC elbows allowed if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
 2. GRS elbows are required if conduit run is 150' or greater.
 3. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
 4. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2" lapped) to 3" above finish grade or top of slab.
- G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. All strut ends shall be deburred and coated with a cold galvanized paint. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) are not allowed. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.
- H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.
- I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).
- J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3" into conduit.
 2. Fill 3" of conduit with 3M #2123 sealing compound.
 3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
 4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
 5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
 6. Provide cable drip loop minimum 12" high.
- K. Marker tape: Place 6" wide mylar/aluminum traceable marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording. Color code marker tape as follows:

1. Electrical Power – RED
 2. Communications - ORANGE
- L. Conduits for high voltage (12kv) systems shall be separated from all other conduits by a minimum of 12". All power system conduits shall be separated from low voltage systems by a minimum of 12" when running parallel to each other and no less than 6" when running perpendicular to each other at conduit crossings.
- M. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.
- N. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.
- O. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.
- P. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.
- Q. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
 2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.
- R. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.
- S. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

- T. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- U. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- V. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
- W. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
- X. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
 - 1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
 - 2. Outlet above counter (measured to top of outlet box): +46".
 - 3. Control (light) Switches. (measured to top of outlet box): +48".
 - 4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
 - 5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
 - 6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- Y. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.
- Z. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.
- AA. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
 - a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
 - 1) Enclosures for switchboards, panels, pullboxes, cabinets, motors.
 - 2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
 - 3) Wall switches not within sight of outlet controlled.
 - 4) Special systems such as, but not limited to fire alarm and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
 - 5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
 - 2. Conductor and Cable Identification.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
 - 3. Section 26 24 16, PANELBOARDS.
 - 4. Section 26 28 16, ENCLOSED SWITCHES AND CIRCUIT BREAKERS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

- A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.

- B. Panelboard labels showing panel designation, voltage, phase and source.
- C. In accordance with CEC 110.16, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

- A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.
- B. For Emergency Equipment: Use engraved white letters over red background.
- C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.
- D. Arc flash labels shall be provided as required by CEC Article 70E.
- E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

PART 3 - EXECUTION

3.1 MOUNTING

- A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.
- B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

- A. Panelboards, Switchboards and Special Systems Enclosures: 1/4" identify equipment designation; 1/8" identify voltage rating and source.
- B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16" identify circuit and load served, including location of equipment.
- C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16" identify load served.

3.3 WARNING SIGNS

- A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.
- B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16" stroke minimum.

- C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION 26 05 53

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 09 23 - OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
 - 4. Section 26 27 26, WIRING DEVICES.
 - 5. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.2 SYSTEM DESCRIPTION

- A. The occupancy sensors shall sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.
- B. Upon detection of human activity by the detector, initiate a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.
- C. Sensors shall have factory set PIR sensing sensitivity for maximum sensitivity. Provide time delay at 10 minutes.
- D. Install system in accordance with manufacturer's recommendations and instructions.
- E. All line voltage sensors, control units, and relays UL listed

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.
- C. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

PART 2 - PRODUCTS

2.1 PASSIVE INFRARED SENSORS - GENERAL

- A. The passive infrared sensors shall detect presence, in the floor area being controlled, by detecting changes in the Infrared energy. Detect small movements, i.e., when a person is writing while seated at a desk.
- B. Provide a temperature compensated dual element sensor and a multi element fresnel lens.
- C. The sensor shall utilize DIP switch adjustments for "on" mode operation, time delay, and sensitivity.
- D. Provide a daylight filter which ensures that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.
- E. The sensors not to protrude more than 1 1/2" from the wall or ceiling and should blend in aesthetically.
- F. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.
- G. Low Voltage Sensors:
 - 1. Sensor shall provide complete coverage of the controlled area.
 - 2. Sensors shall operate on 24VDC power.
 - 3. Sensors shall operate remote power switch packs.
 - 4. Sensors can be wired in parallel to allow coverage of large areas.
 - 5. Manufacturers: The Watt Stopper CI Series, or approved.
- H. Wall Switch Sensors:
 - 1. 300 sq. ft. area coverage, with a field of view of 180 degrees.
 - 2. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, a latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
 - 3. Rated to switch loads from 0 to 800 watt incandescent or fluorescent 120 volt and 0 to 1000 watts for 277 volt.
 - 4. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.
 - 5. Provide integral off override switch with no leakage current to the load or ground.
 - 6. Provide hard 1mm poly IR2 lens, soft lens is not acceptable.
 - 7. Manufacturers: The Watt Stopper PW Series, or approved.
 - 8. Dual Relay: Watt Stopper PW-200, or approved.

2.2 ULTRASONIC OCCUPANCY SENSORS

- A. The occupancy sensors capable of detecting presence, in the controlled floor area by detecting Doppler shifts in transmitted ultrasound.

- B. Occupancy sensors are precision crystal controlled and shall not interfere with each other when two or more are placed in the same area. Provide ultrasonic circuit with solid state crystal controlled with advanced signal processing.
- C. Furnish each sensor with a convenient shunt provision enabling an individual to bypass the sensor in the event of failure. This bypass provision pin or device shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.
- D. Ceiling mounted with maximum protrusion of 1.5" and blend in aesthetically with the ceiling.
- E. Provide multi-directional transmitter and ultrasonic receivers that are temperature and humidity resistant.
- F. Sensors can be wired in parallel to allow coverage of large areas.
- G. Sensitivity adjustment shall range from off at "0" to maximum at "10."
- H. Sensors shall operate on 24VDC power.
- I. UL listed power pack consisting of a transformer and contact closure relay in one package. Provide a transformer that is capable of operating up to three occupancy sensors.
- J. Manufacturers: The Watt Stopper Ultrasonic/UW Series, or approved.

2.3 DUAL TECHNOLOGY SENSORS

- A. Utilize same technologies as passive infrared and ultrasonic.
- B. Upon a person entering a space, motion from both technologies must be sensed before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.
- C. Manufacturers: The Watt Stopper DT Series, or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install occupancy sensors as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, occupancy sensors, power supply pack and low voltage wiring.
- B. Verify with manufacturer's representative that the sensors are laid out in compliance to manufacturer's published sensing distribution. Provide additional sensors for complete coverage of the space being sensed.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.2 QUALITY CONTROL

- A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

END OF SECTION 26 09 23

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Distributed Digital Lighting Control System: System includes
 - 1. Digital Lighting and Plug Load Controls

1.2 RELATED SECTIONS

- A. 26 51 00 - INTERIOR LIGHTING

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.
- B. NEMA - National Electrical Manufacturers Association
- C. FCC emission standards
- D. UL - Underwriters Laboratories, Inc. Listings
- E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
- F. UL 20 - General Use Switches, Plug Load Controls

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of NFPA 70.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Catalog sheets and specifications.
 - 2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation instructions.

- C. Shop Drawings: Wiring diagrams for the various components of the System specified including:
 - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 - 2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
 - 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
 - 4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals:
 - 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
 - 2. Operation and Maintenance Manual:
 - a. Include approved Shop Drawings and Product Data.
 - b. Include Sequence of Operation, identifying operation for each room or space.
 - c. Include manufacturer's maintenance information.
 - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - e. Include startup and test reports.
- F. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CAL TITLE 24 P6, as specified in Part 3 of this specification under "COMMISSIONING".

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
 - 2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

- A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This specification is based on products from Watt Stopper/Legrand, Santa Clara, CA. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. System General: Provide a WattStopper, Provide Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
 - 1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 - 2. Task Lighting / Plug Loads: Provide automatic shut off of non essential plug loads and task lighting in spaces as required by the applicable energy code. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
 - 3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
 - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
 - 4. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise

specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

- B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
 2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
 3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
 4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
 6. Handheld remotes for personal control: On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.
 7. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
 8. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
 9. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
 10. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building
- C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
1. Features of the DLM local network include:
 - a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 - b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
 - c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 - d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
 2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with

RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
 1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
 3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
 4. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 5. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100 percent
 - b. Turn off
 - c. Turn on to last level
 7. Each load be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
 8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
 9. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Schedule state, normal or after-hours
 - c. Demand Response enable and disable
 - d. Room occupancy status
 - e. Total room lighting and plug loads watts
 - f. Electrical current
 - g. Total watts per controller
 - h. Total room watts/sq ft.
 - i. Force on/off all loads
 10. UL 2043 plenum rated

11. Manual override and LED indication for each load
 12. Zero cross circuitry for each load
 13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
 14. Dimming Room Controllers shall share the following features:
 - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
 - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 - c. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 1) Establish preset level for each load from 0-100 percent
 - 2) Set high and low trim for each load
 - 3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
 - d. Override button for each load provides the following functions:
 - 1) Press and release for on/off control
 - 2) Press and hold for dimming control
 - e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
 - g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
 - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- B. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
 2. One or two relay configuration
 3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
 4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
 5. WattStopper product numbers: LMRC-101, LMRC-102
- C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
 2. Optional real time current and voltage monitoring (with - M Monitoring option).
 3. One or two relays configurations
 4. Smart 150 mA switching power supply
 5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
 6. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting

7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
 8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.
- D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
 2. Built in real time current monitoring
 3. One, two or three relays configurations
 4. Smart 250 mA switching power supply
 5. Four RJ-45 DLM local network ports. Provide integral strain relief
 6. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
 7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.
- E. On/Off/ Forward Phase Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) rated for 20A total load, with forward phase dimmed loads derating to 16A for some load types
 2. Built in real time current monitoring
 3. One or two relays configurations
 4. Smart 250 mA switching power supply
 5. Four RJ-45 DLM local network ports. Provide integral strain relief
 6. One dimming output per relay
 - a. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-220 series)
 7. WattStopper product numbers: LMRC-221, LMRC-222
- F. Plug Load Controllers shall include:
1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
 2. One relay configuration with additional connection for unswitched load
 3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
 4. Factory default operation is Auto-on/Auto-off, based on occupancy
 5. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
 6. Switching power supply
 - a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
 - b. Smart 250mA (LMPL-201)
 7. RJ-45 DLM local network ports
 - a. Three RJ-45 ports (LMPL-101)
 - b. Four RJ-45 ports (LMPL-201)
 8. Provide a wireless transmitter that can be connected to any Cat 5e network of the lighting controls that will communicate the room's occupancy state to receptacles mounted in the area with integral relays. Binding of the transmitter to the receptacles shall be accomplished by pressing a test button on the transmitter, and then a test button on the receptacle.

9. WattStopper product numbers:

- a. Plug Load Controllers: LMPL-101, LMPL-201.
- b. Wireless Transceiver and Receptacle: WRC-TX-LM, WRC-15-1/2, WRC-20-1/2

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
- 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity, 0-100 percent in 10 percent increments
 - b. Time delay, 1-30 minutes in 1 minute increments
 - c. Test mode, Five second time delay
 - d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - 2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 3. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - e. Ultrasonic and Passive Infrared
 - f. Ultrasonic or Passive Infrared
 - g. Ultrasonic only
 - h. Passive Infrared only
 - i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - 4. One or two RJ-45 port(s) for connection to DLM local network.
 - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 - 6. Device Status LEDs, which may be disabled for selected applications, including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - 8. Manual override of controlled loads.
 - 9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

2.5 DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
- 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity: 0-100 percent in 10 percent increments

- b. Time delay: 1-30 minutes in 1 minute increments
 - c. Test mode: Five second time delay
 - d. Detection technology: PIR, Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 2. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - 4. Two RJ-45 ports for connection to DLM local network.
 - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 - 6. Device Status LEDs including
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
 - 8. Assignment of local buttons to specific loads within the room without wiring or special tools
 - 9. Manual override of controlled loads
 - 10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- B. Units shall not have any dip switches or potentiometers for field settings.
- C. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- D. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
- 1. Left button
 - a. Press and release - Turn load on
 - b. Press and hold - Raise dimming load
 - 2. Right button
 - a. Press and release - Turn load off
 - b. Press and hold - Lower dimming load

- E. Low voltage momentary pushbuttons shall include the following features:
 - 1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Individual scenes may be locked to prevent unauthorized change.
 - d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - e. Ramp rate may be adjusted for each dimmer switch.
 - f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
 - g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Configuration LED on each switch that blinks to indicate data transmission.
 - 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - 5. Programmable control functionality including:
 - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
 - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
 - 6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. Two RJ-45 ports for connection to DLM local network.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- D. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
 - 1. Individual button function may be configured to Toggle, On only or Off only.

2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DLM HANDHELD USER INTERFACE REMOTES

- A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
 1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
 2. LED on each button confirms button press.
 3. Load buttons may be bound to any load on a load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
 4. Inactivity timeout to save battery life.
- B. Provide with a wall mount holster and mounting hardware for each remote.
- C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

2.8 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
 1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone
- B. Digital daylighting sensors shall include the following features:
 1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
 3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
 4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-

- selectable minimum level.
 - 6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
 - 7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
 - 8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
 - 9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
 - 10. Configuration LED status light on device that blinks to indicate data transmission.
 - 11. Status LED indicates test mode, override mode and load binding.
 - 12. Recessed switch on device to turn controlled load(s) ON and OFF.
 - 13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - a. Light level
 - b. Day and night setpoints
 - c. Off time delay
 - d. On and off setpoints
 - e. Up to three zone setpoints
 - f. Operating mode - on/off, bi-level, tri-level or dimming
 - 14. One RJ-45 port for connection to DLM local network.
 - 15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
 - 16. Any load or group of loads in the room can be assigned to a daylighting zone
 - 17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
 - 18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- C. Closed loop digital photosensors shall include the following additional features:
- 1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 - 2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 - 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
 - 4. WattStopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:
- 1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted

- light from the interior of the room).
 - 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
 - 3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
 - 4. WattStopper Product Number: LMLS-500, LMLS-500-L.
- E. Dual loop digital photosensors shall include the following additional features:
- 1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
 - 2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
 - 3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
 - 4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
 - 5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
 - 6. Device must include extendable mounting arm to properly position sensor within a skylight well.
 - 7. WattStopper product number LMLS-600

2.9 HANDHELD CONFIGURATION TOOLS

- A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
 - 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 - 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 - 3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
 - 4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
 - 5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 - 6. Adjust or fine-tune daylighting settings established during auto-configuration, and input

- light level data to complete configuration of open loop daylighting controls.
- 7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
- 8. Verify status of building level network devices.

C. WattStopper Product Numbers: Handheld LMCT-100

2.10 EMERGENCY LIGHTING CONTROL DEVICE

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
 - 1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 - 2. Push to test button
 - 3. Auxiliary contact for remote test or fire alarm system interface
- B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
 - 1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
 - 2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
 - 3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
 - 4. Low voltage wiring topology must comply with manufacturer's specifications.
 - 5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
- D. Test all devices to ensure proper communication.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while

occupied.

- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - 3. Load Parameters (e.g. blink warning, etc.)
- G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
- I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
 - 1. Verify Class I and II wiring connections are terminated properly by validating system performance.
 - 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
 - 3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
 - 4. Verify that the control of each space complies with the Sequence of Operation.
 - 5. Correct any system issues and retest.
- C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
 - 1. Date of test or inspection.
 - 2. Loads per space, or Fixture Address identification.
 - 3. Quantity and Type of each device installed
 - 4. Reports providing each device's settings.

3.4 COMMISSIONING ASSISTANCE

- A. Title 24 Acceptance Testing Service; Include additional costs for Lighting Control Manufacturer to provide a technician for one additional day while the CLCATT performs lighting control acceptance testing in accordance with CAL TITLE 24 P6 including

submission of required documentation.

3.5 DEMONSTRATION AND TRAINING

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
 - 1. Confirmation of entire system operation and communication to each device.
 - 2. Confirmation of operation of individual relays, switches, and sensors.
 - 3. Confirmation of system Programming, photocell settings, override settings, etc.
 - 4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.6 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION 26 09 43

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Panelboards.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
 - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. No. 50 Enclosures for Electrical Equipment
 - 2. No. 67 Panelboards
 - 3. No. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures
- C. National Fire Protection Association (NFPA):
 - 1. No. 70-2022 California Electrical Code (CEC)
- D. National Electrical Manufacturers Association (NEMA):
 - 1. No. PB-1 Panelboards.
 - 2. No. AB-3 Molded Case Circuit Breakers and Their Application.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, CEC and as shown on the drawings. Approved manufacturers are Square D (NQ Series or I-Line). Eaton may be substituted if pre-approved by the Engineer of Record and only if Square D is not available. Siemens and General Electric will NOT be permitted.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.
- D. All panelboards shall be completely factory assembled with molded case circuit breakers. All factory wiring shall be checked for correct tightness and visually inspected to insure that bussing and terminations have not become loose in transit to job site.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Refer to single line diagram and panel schedules on drawings. Terminals shall be minimum 75 degree rated. Back fed main circuit breakers are not allowed. Main circuit breakers shall be vertically mounted.
- F. Panelboards shall have the following features:
 - 1. Nonreduced size copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
 - 2. Full size copper neutral bar, mounted on insulated supports.
 - 3. Copper ground bar and isolation ground bar (where called for in panel schedule) with sufficient terminals for all grounding wires. Buses braced for the available short circuit current.
 - 4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps. Where used for heating and air conditioning, and refrigeration equipment, use only HACR type U.L. listed circuit breakers.
 - 5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping.
 - 6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
 - 7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
 - 8. Series rated panelboards are not permitted.
 - 9. Label all panels in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

10. Recessed panel space conduit: Provide (1) $\frac{3}{4}$ inch spare conduit stubbed to accessible ceiling space and/or interstitial space below floor for every (5) spaces and spares indicated on panel schedules.
- G. Panelboards serving as building mains shall be "service entrance rated" and UL Listed as "service equipment".

2.2 CABINETS AND TRIMS

- A. Cabinets:
 1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
 2. All ventilated openings in panelboards and switchboards, shall be furnished with dust filters to prevent entrance of dust and debris.
 3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
 4. Provide necessary hardware for "in" and "out" adjustment of panel interior.
 5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 $\frac{1}{2}$ " apart and coupled by conduit nipple if necessary.
 6. Gutter size in panel boxes, on all sides, shall be in accordance with the CEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.
- B. Trims:
 1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
 2. Flush trims shall overlap the box by at least $\frac{3}{4}$ " all around.
 3. Surface trim shall have the same width and height as the box.
 4. Flush or surface trims shall not have ventilating openings.
 5. Secure trims to back boxes by indicating trim clamps.
 6. Provide a welded angle on rear of trim to support and align trim to cabinet.
 7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.
- C. Doors:
 1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
 2. In making switching devices accessible, doors shall not uncover any live parts.
 3. Provide concealed hinges welded to the doors and trims.
 4. For lighting or power contactors incorporated in panelboards, provide separate doors for the contactors.
 5. Provide keyed alike system for all panelboards.
 6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.
- D. Painting:
 1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Breakers shall be UL listed and labeled, in accordance with the CEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
 - 1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated.
 - 2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3 times to 10 times for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.
- C. Breaker features shall be as follows:
 - 1. Integral housing of molded insulating material.
 - 2. Silver alloy contacts.
 - 3. Arc quenchers and phase barriers for each pole.
 - 4. Quick-make, quick-break, operating mechanisms.
 - 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
 - 6. Electrically and mechanically trip free.
 - 7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 - a. Line connections shall be bolted.
 - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings. The interrupting rating shall not be less than the minimum identified requirement.
 - 8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with CEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes and layout of cabinets within the designated spaces. All equipment must be dimensioned in order to physically fit in the spaces provided and to comply with all code required clearances.

- C. Install a typewritten schedule of circuits in each panelboard. Include the room numbers (as finally described by the Owner) and items served on the cards. Obtain final room numbers from Architect prior to creating schedule.
- D. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 78 inches.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Circuit numbers shall correspond to the approved panel schedule. Provide as-built drawings showing the actual circuit numbers being used for each device on each branch circuit if changes are required.
- G. Verify depth of all flush mounted enclosures in walls to be certain wall depth will accommodate panel depth prior to installation.
- H. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.

END OF SECTION 26 24 16

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Wiring devices.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
 - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
 - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
 - 2. Receptacles shall be of a screw terminal type, "pressure type quick wire" terminations are not allowed.
 - 3. 15 ampere and 20 ampere, 125-volt and 250-volt non-locking receptacles shall be tamper resistant type receptacles unless the application is specifically listed as an exception to CEC 406.12.
 - 4. Receptacles shall be "wet rated" when used in an exterior location.
- B. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be white in color. Contractor to verify device color with Architect prior to procurement.
 2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
 3. Controlled receptacles; installed per requirements of 2016 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.
 4. Duplex Receptacles on Emergency Circuit: Receptacle bodies shall be red in color. Wall plates shall also be powder coat painted red finish. Cover shall be labeled with panel and circuit number.
 5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
 - a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.
- ~~D.~~ Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. All on-grade weatherproof receptacles to be Midwest #U010010GRP or #U012010GRP. Otherwise, all non-on-grade weatherproof receptacles permitted to be Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

2.2 SWITCHES AND DIMMERS

- A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and be of a screw terminal type.
 2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
 3. Ratings:
 - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
 - b. 277 volt circuits: 20 amperes at 277 volts AC.
 4. The switches shall be mounted on the strike plate side of doors.
 5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.

6. All toggle switches shall be of the same manufacturer.

- B. Coordinate lighting control device requirements with 26 09 43 Network Lighting Controls System.

2.3 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.
- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.
- F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.
- B. Installation shall be in accordance with the CEC, NECA "Standard of Installation", and as shown as on the drawings.
- C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.
- D. General: Devices shall be of the type specified herein. All devices shall be installed with "pigtailed" leads from the outlet box. No device shall be used in the "feed through" application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.
- E. Installation: Devices and plates shall be installed in a "plumb" condition and must be flush with the finish surface of the wall where boxes are recessed.
- F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- G. Install switches with the off position down.
- H. Clean debris from outlet boxes.
- I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.
- J. Test each receptacle device for proper polarity.
- K. Receptacles shall be wired and mounted in a "ground-up" configuration, such that the topmost receptacle's ground connection is in the top-position of the finished outlet.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Disconnect and safety switches where shown on the contract drawings and specified herein.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
 - 1. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Approved Manufacturers: Square-D. Eaton may be substituted if pre-approved by the Engineer of Record.
- B. Disconnect Switches: Provide with devices enabling the switch to be locked in the open or closed positions.
- C. Manual Motor Switches: Tumbler type rated 3HP, 240 Volts with or without overload heaters as required to protect equipment served.
- D. Externally Operable Safety Switches: To have quick-make, quick-break mechanism, capable of switching 10 times switch rating, with cover interlock to prevent opening with switch in ON position and defeat mechanism for maintenance.
- E. Switches: Shall be general duty (GD) for 240 volt and below and heavy duty (HD) for 277/480 volt type unless otherwise indicated. Provide NEMA 1 enclosures for interior locations and NEMA 3R enclosures for exterior or wet locations. Provide with number of poles, ampacity, voltage and HP rating, fusible or nonfusible as indicated. Copper blades shall be visible in off position.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- F. Fusible Switches: Equip them with rejection clips for UL Class R fuses. Switches having a dual rating when used with dual element fuses shall have a rating so indicated and shall be confirmed by equipment vendor being connected.
- G. 600 Amperes or Less Fuses: UL Class RKI with a minimum interrupting rating of 200,000 Amperes, Bussmann "Low-Peak Type" or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Locations: Install switches, disconnects and safety where indicated on the Contract Drawings or as required by CEC.
- B. Fastenings: Securely fasten switches to structural members or unistrut support as directed by the manufacturer. All strut end to be deburred and coated with a cold galvanized paint.
- C. Label all disconnect switches in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- D. Fuse: All fuses shall be as indicated on the plan or as required by the equipment. Verify fuse size with equipment manufacturer requirements, prior to installation. Use current limiting fuses as indicated on plan. Provide one spare fuse cabinet in each electrical room with one complete set of spare fuses for all sizes of main fuses, subpanel fuses, HVAC equipment fuses and fire alarm.
- E. Terminals shall be minimum 75 degree rated.

END OF SECTION 26 28 16

SECTION 26 31 00 - SOLAR PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section:
 - 1. Specifies the design, engineering, furnishing, installation, connection, testing, and commissioning of solar energy electrical power generation systems.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
 - 3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
 - 4. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
 - 5. Section 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Requirements for enclosed disconnect switches.

1.3 DESCRIPTION

- A. Provide materials, labor, equipment, installation, testing, services and incidentals necessary to install a complete solar PV system and battery energy storage system feeding AC power to the utility grid in accordance with IEEE 1547 and local utility regulations. Provide complete design and shop drawings in accordance with general conditions. The PV system and associated battery energy storage system must comply with these specifications, all applicable codes and standards, all construction documents, and all local AHJ's.
- B. Provide a fully integrated grid tied photo-voltaic system complete and suitable for outdoor roof top use, sized as follows:

- C. The minimum required system size as specified on design drawings or as required per California Title 24 2022 Building Energy Efficiency Standards Section 140.10, whichever is greater. The intended system size is as indicated in the construction documents.
 - a. 120/208V, 3ph, 4wires is the building service voltage. PV System and associated battery energy storage system (where required) shall interconnect at this voltage.
 - b. Locate inverters as shown on the construction documents.
 - c. PV module string voltage shall not exceed 500VDC.
 - d. PV system DC voltage drop shall be 3% or less.
 - e. PV system AC voltage drop shall be 2% or less.
- D. Provide a fully integrated battery energy storage system in compliance with 2022 California Building Energy Efficiency Standards section 140.10 and Reference Joint Appendix JA12, and able to operate in parallel and tandem with the grid-tied PV system (either via AC or DC coupling).
- E. It is the intent of these specifications to ensure that the PV systems installed are consistent with and adhere to any and all California Building Codes and standards, the California Energy Commission's Solar Equipment List, and applicable utility rules and tariffs.
- F. The system shall be designed by a licensed electrical engineer and installed by a licensed electrical contractor.
- G. Provide all necessary components and accessories for a complete, secure, and operational solar PV system, including:
 - 1. PV modules (framed)
 - 2. Grid-tied inverters
 - 3. Overcurrent protection/combiner boxes, as well as rapid shut-down hardware/systems (as required).
 - 4. DC and AC balance of systems, including including raceways, boxes, gutters, enclosures, grounding, quick-connect electrical connectors, DC wiring and disconnects, AC wiring and disconnects, transformers and AC panelboard/switchboards (as applicable)
 - 5. Mounting/racking system and associated hardware, including structural supports system.
 - 6. Battery energy storage system.
 - 7. Inverter based web monitoring system.

1.4 SUBMITTALS AND SHOP DRAWINGS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Submit detailed information for components of the solar electrical generation system, including for those mentioned in Part 1.03.F. of this specification. This detailed information shall include

rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, and manufacturer warranty information.

- C. Submit certifications two weeks prior to final inspection, including the following:
 - 1. Certification by the manufacturers of all major items of the solar energy electric generation system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.
 - 2. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warranted. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.
- D. Submit copies of all applications and documentation provided to the serving utility related to interconnection and net metering required per CPUC Electric Rule 21. In all cases, the serving electric utility may have a requirement for further electrical studies, which may include (but are not limited to) power factor analysis, short circuit protection studies, grid wiring adequacy, or capacities of upstream equipment. If such requirements exist and are required by the serving electric utility and substantially increase interconnection costs or the ability to interconnect the project, the Contractor shall promptly notify the Owner and seek approval from Owner before making any changes to the interconnect application. These additional utility requirements shall be fulfilled by the Contractor at the Owner's expense.
- E. Provide written documentation confirming the utility's approval of the interconnection of the solar energy electrical power generation system with the utility system. The Contractor shall be responsible for all interconnection coordination during design and construction, including review of any previous interconnect applications, utility company coordination, revisions to interconnect applications as-needed, inspections, permits, and final approval for the complete interconnection of the PV systems with the utility company grid, including bi-directional utility meters at each location. The Contractor shall ensure that the design and construction does not void any tariff grandfathering achieved by the initial interconnect applications submitted with the utility.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
 - 1. UL 467 - Standard for Safety Grounding and Bonding Equipment
 - 2. UL 1703 – Standard for Flat-Plate Photovoltaic Modules and Panels
 - 3. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

4. UL 2703 – Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for use with Flat-Plate Photovoltaic Modules.
 - C. Institute of Electrical and Electronics Engineers (IEEE)
 1. No. 929-2000 - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems
 2. No. 1547-2018 - Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
 3. IEEE Standards Dictionary: Glossary of Terms & Definitions (2009)
 - D. International Electrotechnical Commission (IEC)
 1. No. 62446-1 - Photovoltaic (PV) Systems - Requirements for Testing, Documentation and Maintenance - Part 1: Grid Connected Systems - Documentation, Commissioning Tests and Inspection
 - E. ASTM International (ASTM)
 1. No. E772-15 - Standard Terminology of Solar Energy Conversion
 2. No. E2848-13 - Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance
 3. No. E3010-15 - Standard Practice for Installation, Commissioning, Operation, and Maintenance Process (ICOMP) of Photovoltaic Arrays
 - F. American National Standards Institute (ANSI)
 1. No. C12.1-16 - Electric Meters - Code for Electricity Metering
 - G. National Fire Protection Association (NFPA):
 1. No. 70-2022 California Electrical Code (CEC), with State of California Amendments
 - H. National Electrical Manufacturers Association (NEMA):
 1. No. 250-14 - Enclosures for Electrical Equipment (1,000 Volts Maximum)
 - I. California Building Code (CBC), with State of California Amendments
 - J. California Energy Commission Title 24 Building Energy Efficiency Requirements
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Storage of equipment for the job is the responsibility of the Contractor and shall be scheduled for delivery to the site, as the equipment is required. All materials shall be delivered new, undamaged and without defects. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Contractor.

- B. All components shall be new and direct from the respective manufacturer; used or refurbished materials are not permitted.
- C. Store solar PV modules in the original packaging according to the manufacturer's guidance and are to remain in packaging until day of installation. If a solar PV module is removed from its packaging, store according to the manufacturer's guidance.
- D. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.
- E. Appropriate protective clothing shall be worn when handling the equipment.
- F. Where PV systems will be installed on a roof or overhead, all materials stored on the roof shall be distributed so as not to overload the roof at any point. All materials stored on roof shall follow the guidelines of the roofing system manufacturer including protection boards, pallets and/or mats to prevent damage to the roof system and insulation assemblies. All roof top construction, construction related traffic and staging areas shall have protection boards in place to prevent damage to the roofing system and insulation assemblies.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Only products that are listed, tested, identified, or labeled by UL, FM, ETL, or another Nationally Recognized Testing Laboratory shall be used as components in the project. Non-listed products are only permitted for use as project components when a comparable useable listed component does not exist. Non-listed products proposed for use as components must be identified as such in all submittals.
- B. No substitution for contracted equipment shall be made without the written consent of Owner and EOR.
- C. Modules:
 - 1. Solar PV module manufacturer, model, and number of modules must match the approved plans or substitutions may be allowed upon approval by the EOR.
 - 2. PV modules must be listed on the California Energy Commission's Solar Equipment List and meet California SB1 Guidelines for Eligibility.
 - 3. Module manufacturer shall provide a 25-year warranty on the solar modules with at least 80 percent power output guaranteed at 25 years. The solar module manufacturer shall confirm that the warranty applies on an "as installed basis," i.e., the warranty will confirm the panels were installed according to its requirements and specifications for installation. Moreover, the manufacturer shall have a minimum 10-year product warranty that ensures the products will be free from defects in materials and workmanship. The warranty shall last for ten (10) years from the date of purchase. The glass shall not cloud or discolor; the cable and connector plug shall function. The aluminum frames shall not suffer damage due to freezing.

4. Be the same manufacturer, the same size, the same wattage, and the same model.
5. Have a minimum 25-year design life, designed for normal, unattended operation.
6. UL 1703 listed.
7. UL listed for the specified voltage (typically 1000 V-DC).
8. Meet IEC 61215 (crystalline silicon PV modules) standards.
9. Each PV module shall include bypass diodes installed in the module junction box.
10. Manufacturers: Jinko Solar 72-Cell or engineer approved equal.

D. Inverters:

1. Inverter(s) manufacturer, model and quantities shall match as per the approved plans.
2. String-type inverters with integrated AC and DC disconnects (in compliance with applicable codes and utility requirements).
3. Field-tested product line that has been commercially available for no less than 2 fiscal years.
4. Equipped with the following:
 - a. Integrated DC input disconnect.
 - b. Surge Protection
 - c. Ground fault interrupter
 - d. Data monitoring system
 - a. System approved by the California Energy Commission that meets applicable state regulations.
5. Comply with the following:
 - a. UL 1741 listed, inclusive of UL 1741-SA requirements.
 - b. IEEE 1547, including testing to IEEE 1547.1 and IEEE C62.45.
 - c. CPUC Electric Rule 21, California Energy Commission approved and utility line interactive type. Listed on the California Energy Commission's Solar Equipment List.
 - d. Sized as required to support the PV module production load within the rating of the equipment, together with all other components. Sizing shall not exceed 1.30 DC:AC ratio without approval by Owner and manufacturer.
6. Internal combiner panel option to allow connections of sub-arrays at the Inverter without the use of additional equipment.
7. Manufacturers: Solark 208V 3-phase string inverters, or engineer approved equal.

E. Battery Energy Storage System:

1. Provide a fully integrated battery energy storage system in compliance with 2022 California Building Energy Efficiency Standards section 140.10 and Reference Joint Appendix JA12, and able to operate in parallel and tandem with the grid-tied PV system (either via AC or DC coupling).
2. BESS shall have a self-contained enclosure with built-in temperature control and fire suppression system.
3. BESS shall utilize Lithium Iron Phosphate Batteries modules. BESS shall accept the quantity of battery modules to achieve the storage capacity as specified.
4. Locate the BESS as indicated on associate electrical plans.
5. Per 2022 California Building Energy Efficiency Standards section 140.10(b), all buildings that are required by Section 140.10(a) to have a PV system shall also have a battery storage system meeting the minimum qualification requirements of Reference Joint Appendix JA12. The battery system rated energy capacity and the rated power capacity shall be not less than the values as determined by the equations present in section 140.10(b).
6. The primary function of the battery storage system is daily cycling for the purpose of load shifting, maximized solar self-utilization, and grid-harmonization. The system to be provided is not intended to support off-grid/back-up power capabilities.
7. Battery storage system shall be certified to the California Energy Commission's Solar Equipment List.
8. The battery storage system shall be tested in accordance with the applicable requirements given in UL1973 and UL9540. Inverters used with battery storage systems shall be tested in accordance with the applicable requirements in UL1741 and UL1741 Supplement A.
9. Shall meet or exceed the following:
 - a. Single Charge-discharge cycle AC to AC (round-trip) efficiency of at least 80 percent.
 - b. Energy capacity retention of 70 percent of nameplate capacity after 4,000 cycles covered by a warranty, or 70 percent of nameplate capacity under a 10-year warranty.
10. Control Requirements:
 - a. The battery storage system shall have the capability of being remotely programmed to change the charge and discharge periods.
 - b. During discharge, the battery storage system shall be programmed to first meet the electrical load of the facility. If during the discharge period the electrical load of the facility is less than the maximum discharge rate, the battery storage system shall have the capability to discharge electricity into the grid upon receipt of a demand flexibility signal from the local utility or a third-party aggregator.
 - c. At the time of inspection, the battery storage system shall be installed to meet one of the control strategies listed in Reference Joint Appendix JA12.

11. The battery storage system and the associated components, including inverters, shall comply with all applicable requirements specified in Rule 21 and Net Energy Metering (NEM) rules as adopted by the California Public Utilities Commission (CPUC).
12. Manufacturers: Solark Limitless Lithium Battery Energy storage system, or engineer approved, energy code compliant equal.

F. System electrical:

1. The modules shall be interconnected using cable assemblies. The pigtails shall be quick-connect electrical wiring connections rated for the application (90-degree rated). DC string connectors for homerun wires and jumpers provide by the Contractor must match the make and model of the connectors supplied with the PV module, or must be UL listed as compatible with the connectors supplied with the PV module.
2. All Balance of Systems (wiring, component, raceways, and connections) must be suited for conditions for which they are to be installed. If selected inverter(s) are not rated NEMA 3R or better and are installed in exterior locations, then they shall be installed in all-weather NEMA 4X enclosures.
3. AC conductors in raceways shall be Type THWN-2 or XHHW-2 for wet and dry locations. AC conductors shall be installed in raceways.
4. All AC circuits to be 3-wire or 4-wire + ground, as required by inverter manufacturer's installation manual. All grounding per CEC 690, Part V.
5. DC PV string conductors shall be Type PV or USE-2/RHW-2 marked minimum 1000V and sunlight resistant.
6. All DC circuits and feeders sized to CEC table 310.15(B)(16) (90-degree column). Minimum ampacity shall be 156% of the rated short circuit current available to be carried on the specific conductor. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per CEC, and conduit fill derating as required. Provide equipment grounding conductor in each conduit.
7. All DC circuits to be 2-wire + ground.
8. Above ground exposed conduit shall be rigid galvanized steel with threaded fittings except where AHJ and other applicable codes or specifications specifically allow for the use of EMT conduit. All conduit shall meet CEC Code, AHJ Guidelines and any applicable standards. Exterior installations shall have watertight fittings. All conduit shall be rated for exposed installation and a minimum design life equivalent to the solar panels. Paint all visible exposed raceways and boxes mounted on the side of buildings to match adjacent surface finish after installation. Colors to be selected and approved by the Owner.
9. All roof and exterior mounted raceways shall be designed and installed to accommodate expansion and contraction due to heating affects, including adequate cable length and listed expansion couplings. All expansion couplings or installations shall include grounding bonding jumpers as required by code.

10. All interior conduit to be EMT with steel set-screw fittings (no cast fittings).
11. Raceway system shall be installed in a manner that prevents water from draining into electrical equipment.
12. The PV system shall be designed to automatically drop offline when normal utility power is lost to avoid unintentional islanding effects as required by the local utility.
13. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use
14. All required overcurrent protection and electrical bussing sizes per CEC 690.
15. Means of system grounding to be approved by professional Electrical Engineer of record and GFCI protection shall be in accordance with CEC requirements.
16. Provide arc-fault protection where applicable per CEC 690.11.
17. Add Rapid shut-down capability (as applicable) in compliance with CEC 690.12 requirements (Rapid Shutdown of PV Systems on Buildings).
18. Outdoor grounding connections between dissimilar metals (such as aluminum lugs and copper wire) will be protected against galvanic corrosion by the application of outdoor-rated deox or conductive joint compound between the interfacing metal surfaces.

2.2 WIRE MANAGEMENT

- A. All wiring methods must meet or exceed current industry standards for wire management, strain relief and fastening.
- B. All DC string wire management shall use stainless steel or galvanized steel cable clips, Heyco or similar. UV rated cable ties shall be used minimally and only in locations where the use of cable clips is impossible.
- C. Wiring shall not be routed over sharp edges of structural members, equipment or modules.
- D. Wiring shall be routed under the modules of the array wherever possible to avoid direct exposure to the sun or elements.
- E. Wiring shall be secured under the array so as to prevent excessive slack resulting in wire motion, and to minimize visibility of inter-module and home run wiring to the public.
- F. Excess slack in the wire shall be secured such that it is in the module channel or secured to the junction box of the module. Factory-installed wire leads for modules can be wrapped around the junction box of the module.
- G. Where exposed, wires, cables and conductors shall be managed in a neat and orderly manner. Where exposed to environmental conditions (e.g., sunlight, rain, wind, etc.) and visible from below, wires shall be fastened in a uniform and discrete fashion.

- H. Strain relief and drip loops shall be utilized at all entrances to and from conduit bodies, junction boxes, weather heads, switchgear, inverters and panelboards etc. Conductors shall be strapped with strain relief as not to stress panel leads, home runs or mechanically crimped connections within the array. Sufficient slack shall be provided at both ends of cables to allow service and re-termination, and to prevent thermal expansion and contraction from stressing connections.
- I. Conductor Color Codes
 - 1. AC Circuits (<600V): Conductors must be color-coded by phase and voltage as required by CEC, the AHJ, and the utility.
 - 2. DC Circuits, grounded: Positive-Red, Negative-White
 - 3. DC Circuits, ungrounded: Positive-Red, Negative-Black
 - 4. For phase and neutral conductors 6 gauge or larger, permanent thermoplastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.
- J. Conductor Identification
 - 1. All conductors, including DC homerun circuits, shall be labeled at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers.
 - 2. Labels shall indicate circuit or string and phase in accordance with the project drawings.
- K. Tape and Splice Kits
 - 1. Wire splice kits shall be UL listed for their manner of use, such as direct burial or wet operation. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with listed insulation approved by the manufacturer for use with the splice, or as contained in the listed splice kit. Free ends of conductors connected to energized sources shall be taped.
 - 2. Thermoplastic insulating material approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications. Standard electrical tape shall not be the sole insulation material for splices unless explicitly listed for use in the application and meeting the temperature rating of the insulation requirements for the splicing connection.
- L. Terminations
 - 1. Terminations of conductors shall be performed to the requirements and recommendations listed within the manufacturer manuals of the termination hardware and equipment where the termination shall occur.
 - 2. Conductors shall be terminated with minimal exposure of the bare conductor.
 - 3. Conductors cannot exceed the size and quantity restrictions of the lug. Contractor to verify equipment lugs supplied will accept the size and quantity of conductors shown in the project drawings.
 - 4. Full engagement of the conductor within the lug must be maintained.
 - 5. Provide necessary coating of anti-oxidation coating on all exposed conductor ends entering the lug.
 - 6. Where mechanical connectors are used, torque all set-screws to manufacturer specifications with a calibrated torque wrench and indicate with torque marks. Torqueing electrical connectors "hand tight" is not allowed.
 - 7. Where compression connectors are used, they must be installed with compression tools and dies approved by the manufacturer for use with the connector.
 - 8. Ensure the final portion of the conductor before entering the termination is not part of a conductor bend (straight on entry).

9. Terminations of aluminum conductors cannot be made within 18 inches of earth/grade.
10. Termination fittings, connectors, and lugs must be rated and listed for the conductor metal type connected.

2.3 STRUCTURAL MOUNTING SYSTEMS AND GROUNDING

- A. The system shall be installed as part of a structural support system designed for the application and approved by the AHJ.
- B. Deviations from AHJ-approved construction drawings shall be documented with structural calculations and construction details; these engineering documents shall be submitted for AHJ approval prior to commencing any work.
- C. Mounting system design needs to meet applicable local building code requirements with respect to snow, wind, and earthquake factors. The photovoltaic array shall be designed to accommodate lateral displacement in the event of an earthquake based on a nonlinear response-history seismic analysis for the appropriate seismic zone. PV arrays shall be seismically restrained from falling off the roof or excessive movement on the roof. Panels shall be installed to resist sliding and pop-up resulting from lateral and vertical seismic forces and displacements per CBC.
- D. All PV hardware components shall be either stainless steel or aluminum. PV structural components shall be corrosion resistant (galvanized steel, stainless steel, composites, or aluminum). Array mounting hardware shall be compatible with the site considerations and environment. Special attention shall be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structures, corrosion resistance, and durability of the mechanical hardware. The use of stainless-steel fasteners and aluminum support structures are required. The use of wood is not acceptable.
- E. All equipment shall be from a manufacturer specializing in production of roof attachment products and racking materials of the type specified with a minimum of 5 years documented experience. All items of a given type shall be the products of the same manufacturer.
- F. The installation of solar systems on roofs shall adhere to the California State Fire Marshal Solar Photovoltaic Installation Guideline and California Fire Code requirements.
- G. Flat and low slope roofs:
 1. Design shall minimize interrow shading.
 2. Panel tilt shall be a minimum of 5 degrees.
- H. Roof attachments shall be installed per manufacturer's requirements and attached to the roof structure per structural requirements and as otherwise described in the construction documents. Copies of the manufacturer's mounting details and instructions shall be presented to the AHJ prior to installation. Moreover, attachments must be constructed in collaboration with the roofing manufacturer responsible for the roof and roofing material warranty to ensure that the roof warranty is not invalidated by the installation of the PV system.
- I. Roof attachments shall be made with an approved sealant. Coordinate with Architect for roof penetration sealing requirements.

- J. Conduit and roof penetrations shall be minimized where possible.
- K. System layout shall meet local fire department, code and ordinance requirements for roof access.
- L. End caps shall be provided on all structural tubing.
- M. Racking grounding shall be achieved by either:
 - 1. UL 2703 listed module mounting and grounding clamps and devices.
 - 2. Direct bolting of the module to the canopy/racking steel structural purlins and UL listed PV module grounding devices.
- N. If PV modules are mounted to a racking system with module mounting clamps, the clamps must be approved for this purpose by their manufacturer as part of a UL 2703 listed assembly. Clamps shall be listed for PV module grounding to galvanized steel substrate, and their installation shall comply with the clamp installation manual and the PV module installation manual.
- O. All PV modules shall be bonded to each other and to the racking system or canopy galvanized steel structural purlins with listed PV module grounding devices and equipment grounding conductors. For a racking system, provide bonding straps between individual rails joining to form a multi-piece railing system. Moreover, an equipment grounding conductor shall ground the PV array to the PV inverter ground bar, and a grounding electrode conductor shall ground the PV inverter to the canopy grounding electrode and grounding system.
- P. Where PV modules and metallic parts of the racking system are grounded and bonded, contact between dissimilar metals such as copper and galvanized steel shall be avoided. Where contact cannot be avoided, outdoor-rated deox or conductive joint compound shall be applied between the interfacing metal surfaces.
- Q. Manufacturers: Ironridge, or other flush mount racking, engineer approved equal system.

2.3 INVERTER WEB MONITORING

- A. Provide web monitoring module (with mobile device application capability) for each inverter (if multiple inverters are provided): factory installed module, detailed power data, energy output graphs for hourly, daily, weekly and monthly graphs of voltage vs. power output, data available for each inverter and the total system, energy output can be exported in spreadsheet format, online help.
- B. The system monitoring capabilities shall, at a minimum, provide the following information in compliance with 2022 California Building Energy Efficiency Standards Reference Joint Appendix JA11.5.
 - 1. The nominal kW rating of the PV system.
 - 2. Number of PV modules and the nominal watt rating of each module.
 - 3. Hourly (or 15-minute interval), daily, monthly, and annual kWh production in numeric and graphic formats.

4. Running total of daily kWh production.
5. Daily kW peak power production.
6. Current kW production of the entire PV system.

2.4 EQUIPMENT REQUIREMENTS

- A. PV inverter and BESS warranty shall be minimum of 10 years.
- B. PV system module workmanship warranty shall be a minimum of 10 years.
- C. PV module performance warranty for 80% output shall be a minimum of 25 years.
- D. PV inverter and modules shall be from Tier I only manufacturers.
- E. Rapid Shutdown
 1. Rapid shutdown of the PV system shall comply with 2022 CEC 690.12.
 2. Rapid shutdown shall be initiated on loss of utility AC or manually from an initiation device located next the PV AC disconnect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all equipment and all required wiring for a complete and operational system. Follow manufacturer's guidelines for the installation of the array components, including mounting hardware and PV modules. Provide required conductor terminations to devices for a complete system to function as specified and indicated. Complete installation must comply with all local building codes, manufacturer's instructions, and applicable industry standards.
- B. All systems must be installed in accordance with all applicable requirements of local electrical codes and the National Electrical Code (NEC), including but not limited to Article 690, "Solar Photovoltaic (PV) Systems" and Article 705 – "Interconnected Electrical Power Production Sources".
- C. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer's instructions.
- D. In seismic areas, systems shall be adequately anchored and braced per details on structural contract documents to withstand seismic forces at the locations where installed.
- E. Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges

that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened. If the system is roof-mounted it shall have direct current ground fault protection according to CEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.

- F. Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer's installation instructions.
- G. Provide safety signage per CEC.
 - 1. All placards shall be machine generated phenolic type with red background and white lettering, affixed to equipment with stainless steel screws or with permanent adhesive where set screws are not feasible. Minimum lettering size to be 1/4" unless otherwise noted or required for legibility.
 - 2. In addition to CEC required signage, provide utility-required system directory placard and utility safety switch identification placard as required by local utility company, to identify all system components.
- H. Utility Interconnection:
 - 1. The Contractor shall complete the submissions for the utility interconnection agreement with the Owner's approval. The Contractor shall submit the required authorization form with the utility to act on behalf of the Owner.
 - 2. The PV system at each Site shall not be interconnected with the Utility's distribution facilities until written authorization from the Utility Company has been obtained. Unauthorized interconnections may result in injury to persons and damage to equipment or property for which the installing contractor may be liable.

3.2 TESTING

- A. Photovoltaic modules and battery modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.
- B. Inverters shall be factory tested for performance and the results shall be included in the Operation and Maintenance manuals.
- C. System testing of the installed photovoltaic array and BESS shall be performed on all system strings and recorded in commissioning documentation and the Operation and Maintenance manuals.
- D. Commissioning of PV Systems shall adhere to IEC 62446-1 requirements and shall include the following at a minimum:
 - 1. Conductors
 - a. AC & DC conductor inspection / megger. Insulation resistance and DC hi-pot testing of each AC and DC conductor, phase-to-phase and phase-to-ground.
 - b. Wire management check
 - c. DC string polarity, Voc & Isc testing and recording
 - d. Confirm all conduits & junction boxes are installed properly/watertight
 - 2. Inspection of DC fusing and disconnects
 - 3. Inspection of AC components: AC Disconnect, Main Switch Board, AC Combiner Panel Boards, Breakers, Fuses, Terminations, Phasing, OCPD operation, etc.
 - 4. Grounding & bonding system inspection and continuity testing

5. Inverters
 - a. Inverter inspections and tests per manufacturer instructions
 - b. Inverter start-up and confirm proper inverter settings
 - c. Inverter output tests - Confirm PV system AC output as expected based on design, insolation and inverter readings
 6. IV Curve Trace, Performance testing and recording
 7. Thermal Imaging
 - a. Check all electrical components while systems are energized
 - b. Spot check, Modules, Inverters, Disconnects, AC system, etc.
 8. Torque spot check on mechanical and electrical terminations
 9. Inspection of corrosion control measures
 10. Confirm signage and placards meet plans
 11. Workmanship evaluation
 12. Confirm web-based monitoring interface operations
 13. Commissioning of any other major electrical infrastructure installed on the project per manufacturer requirements
- E. Testing to be performed per CPUC Electric Rule 21 testing procedures and requirements. All testing to be done on "no-cloud" days to avoid system fluctuation by passing clouds. Contractor to provide all testing and certification / commissioning.
- F. System start-up procedure shall be as outlined by the Manufacturer's Installation Manual(s).
- G. Clean all equipment and PV modules prior to system start-up. PV modules shall be brush-cleaned with soap and water, and thoroughly rinsed.
- H. The local enforcement agency shall verify that all Certificate of Installations are valid for the solar and battery energy storage systems. The battery storage systems shall be verified as a model certified to the Energy Commission as qualified for credit as a battery storage system. In addition, the enforcement agency shall verify that the battery storage system is programmed and operational with one of the controls listed in Joint Appendix JA12. The programmed control strategy at system final inspection and commissioning shall be the strategy that was used in the Certificate of Compliance.

3.3 OPERATION AND MAINTENANCE

- A. As part of the acceptance of the solar PV system, the contractor shall demonstrate satisfactory operation of the system. Provide a hard copy of the complete operations manuals and instruction on how to operate and shut down the solar PV system. The document shall include at a minimum the following:
1. System description and overview
 2. Simplified site plan that shows array naming convention, inverter locations, and disconnects
 3. Safety Details, including shut down procedures
 4. Contact information for the system installer and maintenance personnel
 5. Monitoring system login and operation details
 6. Standard procedures for both Owner and O&M personnel
 7. Maintenance information, including schedules and responsibilities for ongoing maintenance

8. Troubleshooting and repair, including responses to typical issues and responsible parties
 9. Summary table with the following details for each site: Site, System Size, Permission-to-Operate (PTO), Commercial Operation Date (COD), Final Completion Date, AHJ Closeout Date
 10. Any other information that may be required for the Owner to easily and safely interact with, confirm performance, troubleshoot, maintain and/or service the materials and equipment installed under this Contract.
 11. O&M Attachments shall include:
 - a. Permission-to-Operate (PTO) notice and any other pertinent Utility documentation
 - b. As-built Record Drawings, provided as separate document from the fully compiled O&M Manual. The updated as-built drawings shall also include the following details:
 - 1) DC string maps with corresponding inverter nomenclature (ID), locations, serial numbers, azimuth, and tilt.
 - c. Material List - Complete material list of all items furnished and installed, including but not limited to the following: PV Modules, inverters, wiring, combiner boxes, panelboards, switch gear, optimizers, disconnects, boxes, metering and DAS equipment.
 - d. All warranties, cut sheets, and manuals for major equipment.
 - e. System testing and commissioning documentation.
- B. Contractor shall provide two (2) two-hour trainings for owner's personnel that will service equipment.

3.4 FINAL ACCEPTANCE

- A. The acceptance of the solar PV system occurs only after all deficiencies identified by the performance tests and commissioning report are corrected and the system operates successfully during a 30-day initial testing period.
- B. The Owner must sign appropriate certificates, if equipment and systems are operating satisfactorily in accordance with the specifications, stating the system's operation has been tested and accepted at the end of the final start-up and testing.

END OF SECTION 26 31 00

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Interior lighting systems, including luminaires, ballasts, lamps and emergency lighting equipment.
- B. Related Work:
 - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
 - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
 - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
 - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
 - 5. Section 26 56 00, EXTERIOR LIGHTING.
 - 6. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, drivers, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM).
- C. American National Standards Institute (ANSI).

- D. Aluminum Association Inc. (AA).
- E. Illuminating Engineering Society of North America (IESNA).
- F. National Electrical Manufacturers Association (NEMA).
- G. National Fire Protection Association (NFPA).
- H. Underwriters Laboratories, Inc. (UL).

1.5 DEFINITIONS

- A. Lighting terminology used herein is defined in IES
- B. Exception: The term “driver” is used herein to cover both drivers and power supplies, where applicable.
- C. Clarification: The term “LED light source(s)” is used herein per IES to cover LED package(s), module(s), and array(s).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.
- B. Approved manufacturers: Cree, Lithonia preferred. Columbia is acceptable for troffers.

2.2 LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

- C. Ballasts (where applicable) shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers.
- D. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.
- E. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
 - 1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
 - 2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
 - 3. Exterior finishes shall be as shown on the drawings.
- H. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Recessed fixtures shall be manufactured specifically for LED lamps with drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.
- J. Provide wire lamp guard on all exposed lamp fixture/luminaires.

2.3 LED LUMINAIRE REQUIREMENTS

- A. General Requirements:
 - 1. Luminaire shall have an external label per ANSI C136.15
 - 2. Luminaire shall have an internal label per ANSI C136.22.
 - 3. Luminaires shall start and operate in -20°C to +40°C ambient.
 - 4. LED light source(s) and driver(s) shall be RoHS compliant.

2.4 EMERGENCY POWER SUPPLY FOR LIGHTING FIXTURES

- A. Self-contained battery-operated power supply for operating each fixture indicated on the plans for a minimum output of 90 minutes.

- B. The power supply shall be installed integral to the luminaire. Provide with test switch and charge indicator installed integral to the luminaire. The test switch and charge indicator may be installed in a remote ceiling mounted flush J-box for recessed downlights which cannot accept integral components.
- C. Performance: Emergency operation lumen output for fixtures shall be a minimum of 1100 lumens (or 640 lumens in downlights), unless specifically noted otherwise on the associated electrical drawings.
- D. Provide access hatches (for emergency battery future access) adjacent to recessed 6-inch or less diameter downlights installed in inaccessible ceilings.

2.5 LED DRIVER

- A. Driver
 - 1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
 - 2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
 - 3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
 - 4. 0-10 volt drivers only.
- B. Electromagnetic interference
 - 1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
 - 2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- C. The following shall be in accordance with corresponding sections of ANSI C136.37
 - 1. Wiring and grounding
 - 2. All internal components shall be assembled and pre-wired using modular electrical connections.
 - 3. Mounting provisions
 - 4. Terminal blocks for incoming AC lines
 - 5. Latching and hinging
 - 6. Ingress protection

2.6 LAMPS

- A. Provide lamps for all luminaires.

- B. LED LIGHT SOURCE
1. Minimum Color Rendering Index (CRI): 60.
 2. Correlated Color Temperature (CCT)
 - a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260
4500	4260 to 4746
5000	4745 to 5311
5700	5310 to 6020
6500	6020 to 7040

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor's expense.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.
- E. Lighting Fixture Supports:
 1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 4. Hardware for recessed fluorescent fixtures:
 - a. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
 - b. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Earthquake clips" will be required for

- fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.
5. Surface mounted lighting fixtures:
 - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum $\frac{1}{4}$ -20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
 6. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
 7. Single or double pendent mounted lighting fixtures:
 - a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
 8. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- F. Furnish and install the specified lamps for all lighting fixtures as part of this project.
- G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- I. At completion of project, clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.
- J. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.
- K. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of exterior luminaires, controls, and supports.

1.2 RELATED WORK

- A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- C. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 51 00, INTERIOR LIGHTING.
- F. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, drivers, luminaires, lamps and controls.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM).
- C. American Concrete Institute (ACI).

- D. American National Standards Institute (ANSI).
- E. Aluminum Association Inc. (AA).
- F. Illuminating Engineering Society of North America (IESNA).
- G. National Electrical Manufacturers Association (NEMA).
- H. National Fire Protection Association (NFPA).
- I. Underwriters Laboratories, Inc. (UL).

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, as shown on the drawings and as specified.
- B. Approved Manufacturers:
 - 1. LED type (wall pack): Current Lighting LNC2 series or Cree XSPW series.
 - 2. LED type (other): Gardco/Signify, Cree, Lithonia, Hubbell
- C. Exterior Lighting Control Timeclocks:
 - 1. In addition to lighting controls required by CEC, mechanical timeclocks shall be installed. For 7 Day use Intermatic #T7401BC (mechanical with 24-hour backup). For 24 Hour use Intermatic #T103. Install in accordance with the drawings.

2.2 LUMINAIRES

- A. UL 1598 and ANSI C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp heat.
- B. Light emitting diode (LED)-based solid state lighting (SSL) products shall be factory tested in accordance to the International Engineering Society (IES) LM-79 recommendations and meet ANSI C78.377-2008 standards.
- C. LED light sources shall be factory tested in accordance to IES LM-80 recommendations.
- D. LED-based SSL product shall incorporate an external heat sink, integral to the luminaire.
- E. Incorporate associated ballasts and drivers within the luminaire housing.
- F. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.
- G. Pre-wire internal components to terminal strips at the factory.

- H. Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- I. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- J. LED-based SSL luminaires shall be manufactured specifically for LED lamps with drivers integral to the luminaire housing.

2.3 LAMPS

- A. Luminaires shall be listed for the lamp specified on the associated electrical plans. Install the proper lamps in every luminaire installed.
- B. Lamps shall be clear or coated as recommended by luminaire manufacturer to provide for maximum luminaire efficiency in fixture used.

2.4 LED-BASED SOLID STATE DRIVERS

- A. Shall be listed by either U.L. or equal listing agency and comply with IEEE C.62.41-1991, Class A operation.
- B. Provide a minimum power factor of 0.9.
- C. Minimum operating temperature appropriate for outdoor environments.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lighting in accordance with the CEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.2 GROUNDING

- A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or alloyed connectors suitable and listed for this purpose.

END OF SECTION 26 56 00

SECTION 26 56 70 - LIGHTING ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:

1. The Contractor shall be responsible for the Certificate of Acceptance, but coordinate with the Certified California Lighting Controls Test Technician to assure that all required documents have been filed with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
3. Documentation of test results, completion of "Certificate of Acceptance" and "Certificate of Installation" forms and filing with the enforcement agency for approval.
4. Specific Jobsite Conditions:
 - a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.

- B. Related Work:

1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 51 00, INTERIOR LIGHTING.
3. Section 26 56 00, EXTERIOR LIGHTING.
4. Section 26 09 43, NETWORK LIGHTING CONTROLS
5. Section 26 09 23, OCCUPANCY SENSORS.

1.3 REFERENCES

- A. Acceptance Testing Criteria: 2022 Building Energy Efficiency Standards Non-Residential Compliance Manual.

1.4 SYSTEM DESCRIPTION

- A. Performance Requirements:

1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.

B. Scope of Testing, Evaluation and Calibration (as applicable):

1. Automatic (master) time switches.
2. Occupancy sensors.
3. Automatic daylighting controls.
4. Photo electric sensors.
5. Outdoor astronomical time switches.
6. Area controls.

1.5 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. Test Reports:

1. Written record of all tests and completion of forms included in this section.
2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
 - a. Summary of project.
 - b. Description of systems and equipment tested.
 - c. Visual inspection report.
 - d. Description of tests.
 - e. Test results.
 - f. Conclusions and recommendations.
3. Report shall be bound in booklet form, include on the Contractor's letterhead the title of the report and the systems tested.

C. Constructability Plan Review

1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section.

PART 2 - PRODUCTS

2.1 FORMS

A. Lighting Installation forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following website:
<https://energycodeace.com/nonresidentialforms>

B. Lighting Acceptance forms are to be provided by a Certified California Lighting Controls Acceptance Test Technician. The California Energy Commission adopted changes to the California building Efficiency Standards (Title 24, Parts 1 and 6) that require lighting controls and devices to be certified as properly installed and operational, prior to issuance of occupancy permits. All Acceptance Technicians must be employed by an Acceptance Test employer that provides support as well as quality control. Certified California Lighting Controls Acceptance

Test Technicians can be found at the following website: www.calctp.org/acceptance-technicians/contractors

- C. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Contractor's Responsibilities:
 - a. Perform all required tests required by this section.
 - b. Schedule testing with building Owner.
 - c. Provide Installation forms
 - d. Acceptance forms provided by California Certified Lighting Controls Technician hired by Contractor.
 - e. Calibration of equipment such as light meters, photo electric controls, etc.
 - f. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

3.2 ADJUSTING

- A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION 26 56 70

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 26 77 00 - ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide assisted listening systems as described herein.

1.2 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 Assisted Listening Systems

- A. Provide and install complete, ADA compliant Assisted Listening Systems as follows:
 - 1. The campus shall have (as a minimum):
 - a. (1) Portable system consisting of a hard suitcase-style carrying case and containing:
 - 1) (1) Battery operated, belt (clip) FM transmitter unit with lapel microphone.
 - 2) (4) Battery operated, belt (clip) receivers with built in ambient (environmental) microphone and single (bud-style) earphone.
 - 3) (4) Battery operated, heavy-duty folding headphones
 - 4) (1) Omnidirectional desktop conference microphone with 36" cord.
 - 5) (2) 18" neckloops for use with hearing aids or cochlear implants equipped with T-coil switch.
 - b. The portable systems shall be located in the Administration Office available for check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.
 - c. Acceptable Products: Williams Sound "FM ADA Kit 37"
- B. The entire system shall be of one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Williams Sound Corp. or engineer approved equal.
- C. The quantity of wireless headsets on-site shall satisfy the ADA requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types.
- D. In accordance with California Building Code, Assistive Listening Devices shall comply with all requirements set forth in 11B-706.
 - 1. Receivers required for use with an Assistive Listening System shall include a 1/8-inch (3.2mm) standard mono jack.
 - 2. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.
 - 3. Assistive listening systems shall be capable of providing a sound pressure level of 110dB minimum and 118dB maximum with a dynamic range on the volume control of 50dB.
 - 4. The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18dB minimum.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

5. Peak clipping shall not exceed 18dB of clipping relative to the peaks of speech.
- E. In accordance with California Building Code, Assistive Listening Devices shall comply with all signage requirements set forth in 11B-216.10
 1. Each assembly area required to provide assistive listening systems (portable or fixed) shall provide signs informing patrons of the availability of the assistive listening system. The sign shall include wording that states "Assistive-Listening System Available" and shall be posted in a prominent place at or near the assembly area entrance. Assistive listening signs shall comply with California Building Code (CBC) Section 11B-703.5 and shall include the International Symbol of Access for Hearing Loss complying with CBC Section 11B-703.7.2.4.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 2 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION 26 77 00

SECTION 27 13 00 - INTERCOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:
 - 1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
 - 2. The Horizontal (workstation) Cabling System shall consist of a minimum of two (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
 - 3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
 - 4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 REGULATORY REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 or 6A component and channel compliant, as applicable to the component being installed.
- D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
 - 1. ANSI/TIA/EIA - 568-C.0, Generic Telecommunications Cabling for Customer Premises
 - 2. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard.

3. ANSI/TIA/EIA - 568-C.2, Balanced Twisted Pair Cabling Components, Addendum 1 –
4. ANSI/TIA/EIA - 568-C.3, Optical Fiber Cabling Components
5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
7. ANSI/TIA/EIA – 607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – 10th Edition, 2003.
10. National Fire Protection Agency (NFPA – 70), National Electrical Code (NEC) –2019.

- E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.4 APPROVED CONTRACTOR

- A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification. At least (1) for every (3) members of the copper installation and termination crew must be certified to a Technician Level of training by the product manufacturer or BICSI. At least (1) for every (5) members of the optical fiber installation and termination crew must be certified by the product manufacturer or other approved organizations in Optical Fiber installation and termination practices.

1.5 WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.
- B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.
 2. Furnish, install, and terminate all UTP and Optical Fiber cable.
 3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
 4. Furnish and install all required cabinets and/or racks as required and as indicated.
 5. Furnish any other material required to form a complete system.
 6. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.

7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Adhere and comply with all requirements of the product certification programs.
9. Provide owner training and documentation. (Testing documentation and As-built drawings).

1.6 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
 1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
 3. Submit appropriate cut sheets and samples for all products, hardware and cabling with highlighted or otherwise denoted specific products to be used. If product cut-sheets are submitted without specific products highlighted the engineer shall return submittal immediately with "Revise and Resubmit" response.
- C. Work shall not proceed without the Owner's approval of the submitted items.
- D. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

1.7 QUALITY ASSURANCE

- A. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and receipt of products shall be at the site described in the Scope Section.
- B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.
- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.9 DRAWINGS

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

- A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

2.2 WORK AREA OUTLETS

- A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate:
 - 1. A minimum of four (4) modular jacks.
 - 2. Each modular jack shall match in color and category performance the incoming cable plant to each jack location. (i.e. – if incoming cable plant is a BLUE, Category 6 cable, the modular jack shall match Category 6 performance and shall also be BLUE in color).
 - 3. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
 - 4. A blank filler will be installed when extra ports are not used.
 - 5. All modular jacks shall have their circuit number on the faceplate identifier strip.
 - 6. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.
 - 7. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
 - 8. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with

ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:

1. Be as appropriate to fit the modular jack used.
2. Be UL listed and CSA certified.
3. Be constructed of type 302 stainless steel (except where noted otherwise).
4. Shall match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
5. Be compliant with the above requirements along with the following when incorporating optical fiber:
 - a. Be a low profile assembly,
 - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
 - c. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
 - d. Incorporate a shroud that protects the optical couplings from impact damage.
6. Be available as single-gang or dual-gang.
7. Provide easy access for adds, moves, and changes by front removal of jack modules.
8. Possess recessed designation windows to facilitate labeling and identification.
9. Include a clear plastic cover to protect labels in the designation window.
10. Have mounting screws located under recessed designation windows.
11. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
12. Allow for the UTP modules to be inverted in place for termination purposes.
13. Be manufactured by an ISO 9001 registered company.

D. Voice / Data Jacks

- ~~1.~~ Voice/Data jacks, also known as telecommunications jacks, shall be 8-position modular jacks and shall be Category 6 or 6A performance (as matching the installed cable plant) as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6 or Category 6A specifications (as appropriate to match the installed cable plant).
5. The modular jack shall have low emission IDC contacts.
6. The modular jack shall use standard termination practice using 110 impact tool or manufacturer approved tool using trained technician.
7. The modular jack shall be backwards compatible to Category 3, 5, 5e, and 6.
8. The modular jack shall be center tuned to category 6 or category 6A test specifications (as appropriate to match the installed cable plant).
9. Dust covers shall be used on each termination.

2.3 MODULAR PATCH PANELS

A. The Modular Patch Panels shall:

1. Meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory.

2. Use low emission IDC contacts.
3. Use dual reactance technology to enhance the signal-to-noise ratio.
4. Require standard termination practices using a 110 impact tool or manufacturer approved termination tool.
5. Use a single piece IDC housing designed to accept larger Category 6A conductors.
6. Support both T568B and T568A wiring.
7. Include easy to follow wiring labels.
8. Include label fields.
9. Allow for the use of icons.
10. Include full length metal rear cable management.
11. Be available in standard or high density. Installation shall prefer standard density.
12. Be backward compatible to category 3, 5, 5e, and 6.
13. Be center tuned to category 6A test specifications.
14. Design Make:
 - a. Leviton 49255-H24, 24-port patch panel suitable for Category 6A applications.

2.4 RACKS

- A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.
- B. Wall Mounted Rack
 1. Wall mounted rack shall be one of two types of cabinets with requirements as listed below.
 2. Large – surface mounted, enclosed cabinet with tinted front glass, such that I.T. equipment is mounted parallel with finished floor. This type of rack shall be used only where the installed location is normally unoccupied by students, or as noted on plans. Large wall mounted rack shall:
 - a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
 - b. Have top cable trough to route patch and distribution cables between racks.
 - c. Have EIA hole pattern on front and rear.
 - d. Rack height shall be specified as 36" or 4.0 ft/1.22 m (22 rack units).
 - e. Be available with a 6.5" (165 mm) or 14" (356 mm) channel depth.
 - f. Be available with hook and loop straps for securing cables inside the vertical U-channels.
 - g. Be available with vertical cable management rings for cord routing organization and strain relief.
 - h. Be available with vertical U-channels to protect and conceal distribution cables.
 - i. Provide floor and ceiling access for cable management and distribution.
 - j. Have wall mount braces with locator posts for easy wall mounting.
 - k. Have side access points that allow for access to manage/install distribution cables in the vertical channels.

- l. Be available in standard color of black.
 - m. Be available with double-hinge for easy access to rear of equipment and incoming cable plant.
 - n. Be manufactured by an ISO 9001 registered company.
 - o. Be installed with additional accessories as follows:
 - 1) Ground bus kit for equipment and enclosure bonding.
 - 2) Thermostatically controlled fan kit with integral filter.
 - p. Approved manufacturers of large wall mounted racks are: Chatsworth Cube-IT with tinted front glass.
3. Small – surface mounted, enclosed cabinet with minimal depth from finished wall, such that I.T. equipment is mounted perpendicular with finished floor. This type of rack shall be used only where installed location is normally occupied by staff or students, or as noted on plans. Small wall mounted rack shall:
- a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
 - b. Have top cable trough to route patch and distribution cables between racks.
 - c. Have EIA hole pattern on top and bottom, including door mounting, if applicable.
 - d. Cabinet height shall be specified as 42", which shall contain (5) rack units for equipment and (4) rack units for patch panel space.
 - e. Be available with a 6.5" (165 mm) or 14" (356 mm) channel depth.
 - f. Be available with hook and loop straps for securing cables inside the vertical U-channels.
 - g. Be available with cable management rings for cord routing organization and strain relief.
 - h. Provide floor and ceiling access for cable management and distribution.
 - i. Have wall mount braces with locator posts for easy wall mounting.
 - j. Have side access points that allow for access to manage/install distribution cables in the vertical channels.
 - k. Be available in standard color of black.
 - l. Be manufactured by an ISO 9001 registered company.
 - m. Be installed with additional accessories as follows:
 - 1) Ground bus kit for equipment and enclosure bonding.
 - 2) Thermostatically controlled fan kit with integral filter.
 - n. Approved manufacturers of small wall mounted racks are: Hubbell RE-BOX "RE4X" unless otherwise noted.

2.5 HORIZONTAL DISTRIBUTION CABLE

- A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.
- B. 100 OHM Category 6 UNSHIELDED TWISTED PAIR CABLE (UTP)
 - 1. Physical Characteristics:
 - a. The diameter of the insulated conductor shall be .023 in. maximum.
 - b. The outer jacket of the overall cable shall be BLUE in color.
 - c. Shall consist of (4) twisted pairs.
 - d. Shall be suitable for the environment in which they are to be installed.
 - e. The color coding of pairs shall be in accordance with T-568B:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BLW-O; O	W-G; G	W-BR; BR	

- f. The overall diameter of the cable shall be 0.230" nominal.
 - g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
 - h. Cable shall withstand a bend radius of 1" at -20 degrees Celsius without jacket or insulation cracking.
 - i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
- 2. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
 - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
 - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
- 3. Cable shall be Berk-Tek LANmark-1000 UTP or approved equal.
- 4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark-6 OSP (wet location) or approved equal.

C. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)

- 1. Physical Characteristics:
 - a. The diameter of the insulated conductor shall be .023 in. maximum.
 - b. The outer jacket of the overall cable shall be WHITE in color.
 - c. Shall consist of (4) twisted pairs.
 - d. Shall be suitable for the environment in which they are to be installed.
 - e. The color coding of pairs shall be in accordance with T-568B:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BLW-O; O	W-G; G	W-BR; BR	
 - f. The overall diameter of the cable shall be 0.320" nominal.
 - g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
 - h. Cable shall withstand a bend radius of 1.2" at -20 degrees Celsius without jacket or insulation cracking.
 - i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
- 2. Transmission Characteristics:
 - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
 - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 5.1 Nf.
 - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
 - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
- 3. Cable shall be Berk-Tek LANmark-10G2 UTP or approved equal.
- 4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark 10G2 OSP series category 6A (wet location) or approved equal.

2.6 FIBER OPTIC CABLE

- A. Indoor/outdoor optical fiber non-conductive loose tube HYBRID CABLE with both laser enhanced multimode and singlemode fiber strands.
 - 1. Each singlemode fiber must adhere strictly to Section 2.7.C.

2. Each multimode fiber must adhere strictly to Section 2.7.B.
 3. Physical Characteristics (in addition to those outlined below):
 - a. Overall jacket of the HYBRID style cable shall be Aqua.
 - b. Fiber used for fire alarm system shall have an overall jacket that is RED.
- B. MULTIMODE FIBER: Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 50/125 Optical Fibers
1. Each Multimode Fiber shall be:
 - a. Graded-index optical fiber wave-guide with nominal 50/125um-core/cladding diameter, OM4 or better industry rating.
 - b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
 - c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
 - d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
 - e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
 - f. Maximum attenuation dB/Km @ 850/1300 nm: 3.5/1.5.
 - g. Bandwidth 4700 MHz-km @ 850nm.
 - h. Bandwidth 500 MHz-km @ 1300nm.
 - i. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 750m/600m for 850nm and 1300nm respectively and 10 gigabit distances of min. 300m for both 850nm and 1300nm.
 2. Physical Characteristics:
 - a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b. Shall be suitable for use in risers, plenums and horizontal applications.
 - c. Shall have a dry water blocking system for cable core and buffer tubes.
 - d. Shall be available with a fiber strand count range from 6 to 72.
 - e. Shall have a 3.0 mm sub-unit diameter.
 - f. Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
 - g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
 - h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
 - i. Suitable for underground or aboveground conduits.
 - j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
 - k. Shall have a ripcord for overall jacket.
 - l. Suitable for operation between -40° to +75° C.
 - m. Shall be UV resistant.
 - n. Shall be of an all dielectric design.
 - o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
 3. Design Make:
 - a. Berk-Tek "Adventum" optical fiber cable with GIGAlite-10FB 50/125 micron fiber or approved equal.
- C. SINGLEMODE FIBER: Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Laser Enhanced 9/125 Optical Fibers
1. Each Singlemode Fiber shall be:
 - a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
 - b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
 - c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
 - d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.

- e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
 - f. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
 - g. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of >5000m for 1310nm and 10 Gigabit Ethernet distances of >5000m for 1310nm.
2. Physical Characteristics:
- a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
 - b. Shall be suitable for use in risers, plenums and horizontal applications.
 - c. Shall have a dry water blocking system for cable core and buffer tubes.
 - d. Shall be available with a fiber strand count range from 6 to 72.
 - e. Shall have a 3.0 mm sub-unit diameter.
 - f. Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
 - g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
 - h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
 - i. Suitable for underground or aboveground conduits.
 - j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
 - k. Shall have a ripcord for overall jacket.
 - l. Suitable for operation between -40° to +75° C.
 - m. Shall be UV resistant.
 - n. Shall be of an all dielectric design.
 - o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
3. Design Make:
- a. Berk-Tek "Adventum" OS2 optical fiber cable (Singlemode-AB) with 9/125 micron fiber or approved equal

2.7 FIBER OPTIC CONNECTORS

- A. LC Fiber Optic Connectors:
- 1. Each LC fiber optical connector shall be factory terminated onto a factory cut and polished "Pig-Tail" in preparation for field termination by fusion splice only. Mechanical field terminations or gel-matched connector types will not be permitted.
 - 2. Each LC Fiber Connector shall:
 - a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
 - b. Be available in single mode and multimode versions.
 - c. Have a domed zirconia ferrule.
 - d. Be a PC polish type connector.
 - e. Accept a nominal fiber diameter of 125 micrometers.
 - f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
 - g. Have repairable tips.
 - h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
 - i. Be stable over an operating range of -40C to +75 degrees C.
 - 3. Design Make:
 - a. Leviton LC Fiber Optic Connectors on pre-terminated pig-tails or approved equal.
 - b. Fiber optic pigtails shall be fusion spliced only in submitted and approved fiber optic splice trays and enclosures.

2.8 FIBER OPTIC SPLICE ENCLOSURES

- A. All incoming fiber optic cable shall be fusion spliced to pre-terminated and polished "pig-tails" as noted above. This fusion splice shall be mechanically protected using a splice enclosure with modular fiber patching bulk-heads. Each fiber optic splice enclosure shall be mounted inside a physically secure cabinet, or mounted to a free-standing rack inside an IT designated area on premises. Each fiber optic splice enclosure shall:
1. Be able to use interchangeable bulk-heads for both single-mode and multi-mode patching.
 2. Be able to hold one or more 12-strand splice trays
 3. Splice trays shall be:
 - a. Capable of handling maximum of 12 fiber splices per tray, including heat-shrink.
 - b. Capable of being stacked for using in multi-tray installations
 4. Contain integral strain-relief for installed fiber plant.
 5. Be installed with all un-used positions in fiber bulk-heads populated with dust-caps.
 6. Be manufactured by an ISO 9001 registered company
 7. Design Make:
 - a. Installations with 12 or fewer strands shall use Corning "SPH-01P"
 - b. Installations with more than 12 strands shall use Leviton OPT-X 1000i series

2.9 PATCH CORDS

- A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing.
- B. Copper (UTP) patch cords shall:
1. Use 8-position connector with impedance matched contacts and designed using dual reactance.
 2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
 3. Meet TIA category 6 or 6A (corresponding to the matching cable plant) component specifications in ANSI/TIA/EIA-568-B.2-1
 4. 100% factory tested to meet category 6 or 6A corresponding to the matching cable plant performance.
 5. ETL or any other nationally recognized 3rd party verification
 6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
 7. Be capable of universal T568A or T568B wiring schemes.
 8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
 11. Have "snagless" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
 12. Be provided and installed in colors that match installed cable plant.
 - a. Cables with Category 6 performance shall be BLUE.
 - b. Cables with Category 6A performance shall be WHITE.
 13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
 14. Be backwards compatible to Category 3, 5 and 5e.

15. Be manufactured by an ISO 9001 registered company.

C. Optical Fiber patch cords shall:

1. Contain two (2) multi-mode or single mode optical fibers, corresponding with the matching installed cable plant.
2. Use multi-mode, graded-index fibers with a 50 micron core or use single mode fibers with a 9 micron core, corresponding with installed cable plant.
3. Be capable of transmission at both 850 nm and 1300 nm wavelengths for multi-mode and 1310 nm and 1550 nm for single-mode.
4. Include listing of actual loss of patchcord when packaged.
5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.
6. Be manufactured by an ISO 9001 registered company.

2.10 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

2.11 FIRESTOP

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure).

Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

PART 3 - EXECUTION

3.1 WORK AREA OUTLETS

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 12" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.
- E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).
- G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

- D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
- O. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15m) of exiting conduit.

3.3 HORIZONTAL COPPER TERMINATION AND INSTALLATION

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.
- B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.4 OPTICAL FIBER TERMINATION HARDWARE

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.
- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. A maximum of 12 strands of fiber shall be spliced in each tray.
- F. All spare strands shall be installed into spare splice trays.
- G. All terminated strands shall be accounted on patch-panel labels which follow District labelling standards.
- H. All un-used fiber positions in fiber termination bulk-head (also known as adapter plate) shall be populated with manufacturer provided dust caps.

3.5 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

- E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.6 RACKS

- A. Racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.
- B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
- C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.8 of this document.
- D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.
- F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.7 FIRESTOP SYSTEM

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.8 GROUNDING SYSTEM

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.

- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.9 IDENTIFICATION AND LABELING

- A. The contractor shall provide and install a complete labeling system for the intercommunications installation in accordance with ANSI/TIA/EIA-606A, and identified using the following methodology:
 - 1. FACEPLATES (Workstation Outlets): Faceplates in work areas shall be labeled consecutively starting at "1" and incrementing moving in a clockwise motion around each room. Index "1" in each room shall begin at the occupant entrance to the room and shall increment at each occurrence of a new/different faceplate in a clockwise and outermost-to-innermost pattern (spiraling inward). In this manner, labeling of wall outlets will be done first, and floor-boxes will be labeled next.
 - a. The following special configuration prefixes shall be used in front of the nameplate index and port position:
 - 1) Wireless Access Points: shall have additional "WAP" prefix to the index assigned by method 1 above. (Example: WAP2A and WAP2B may share a 2-port biscuit)
 - 2) IP enabled speakers: shall have additional "SPK" prefix to the index assigned by method 1 above. (Example: SPK3A)
 - 3) IP enabled cameras: shall have additional "CAM" prefix to the index assigned by method 1 above. (Example: CAM1A)
 - b. Labeling within each faceplate (or biscuit): Each modular jack shall be identified by a letter to index the individual port within any faceplate, starting at the letter "A". Each port shall be indexed starting in the upper-left and incrementing right-to-left first and then top-to-bottom.
 - 2. RACK EQUIPMENT: Intermediate Distribution Frames (IDF) and Main Distribution Frames (MDF) shall be labeled according to their District-wide recognized room name at the time of installation. The IDF or MDF shall be labelled according to the following naming template:
 - a. Small telecom cabinet shall be of the format: "TIC" <ROOM NAME> (Example: TIC901B is a small IDF cabinet in room 901B).
 - b. Large telecom cabinet or IDF rack shall be of the format: "IDF" <ROOM NAME> (Example: "IDF1205" for a free-standing 2-post rack in room 1205)
 - c. MDF room equipment shall be of the format: "MDF" <ROOM NAME> (Example: "MDF-LIB01" for the main distribution frame in room LIB01)
 - d. During construction, a room name may not correspond to the District recognized room name, therefore Contractor shall seek approval from District IT for recognized room names prior to start of labeling.
 - e. If more than one rack within the IDF or MDF is installed, contractor shall seek special instructions on naming conventions.
- B. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.
- C. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.

- D. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

3.10 FIBER OPTIC DATA CHANNEL

- A. All fiber optic strands within a fiber optic cable shall be installed so as to complete an end-to-end, full-duplex data channel, known as the cable plant. The cable plant shall only be connected at each end to active optical networking equipment/electronics via one patch cable at each end of the installed cable plant. Cable plant shall not be "cross-patched" from one fiber pair to another, even at a specified fiber bulk-head, without explicit approval from Engineer and Owner.
- B. Data throughput shall only be limited by the characteristics of the cable or the capability of the active electronics equipment attached. Cable shall not be limited by channel disturbances, such as kinks, breaks, tears, lossy splices, mating optical patches, etc.
- C. Where plans or specifications call for additions or modifications to an existing fiber channel, Contractor shall only complete the addition or modification using approved fiber optic cable fusion splices, in submitted and approved termination enclosures.

3.11 HORIZONTAL COPPER DATA CHANNEL

- A. All 4-pair, 8-position copper data cables (Category cabling) shall be installed as a complete end-to-end, full duplex ethernet channel, known as the cable plant. The cable plant shall only be connected at each end to active networking equipment/electronics via one patch cable at each end of the installed cable plant. Cable plant shall not be "cross-patched" from one ethernet cable to another without explicit approval from Engineer and Owner.
- B. Data throughput shall only be limited by the characteristics of the cable or the capability of the active electronics equipment attached. Cable shall not be limited by channel disturbances, such as kinks, breaks, tears, additional patch cables, additional punch-downs, etc.
- C. Where plans or specifications call for additions or modifications to an existing data channel, Contractor shall only complete the addition or modification using approved fiber optic cable fusion splices, in submitted and approved termination enclosures.

3.12 TESTING AND ACCEPTANCE

- A. General
 - 1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Link Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
2. Horizontal cabling shall be tested using a Level III test unit for category 6 and category 6A performance compliance, corresponding with the installed cable type.
3. The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation
 - d. NEXT (Near end crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay skew
 - i. PSNEXT (Power sum near-end crosstalk loss)
 - j. PSELFEXT (Power sum equal level far-end crosstalk loss)
4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
6. Category 6 Performance Shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	69.0	64.0	65.3	62.3	21.0
4.0	4.0	67.0	62.5	53.2	50.2	21.0
10.0	6.3	60.6	46.0	45.3	42.3	21.0
20.0	9.0	55.6	51.0	39.2	36.2	21.0
31.25	11.3	52.4	47.7	35.4	32.4	19.1
62.5	16.4	47.4	42.6	29.3	26.3	16.1
100.0	21.2	43.9	39.1	25.3	22.3	14.0
155.0	26.6	40.7	35.8	21.4	18.4	12.1
200.0	31.5	38.8	33.9	19.2	16.2	11.0
250.0	36.0	37.1	32.4	17.3	14.3	10.0

7. Category 6A performance shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	74.3	72.3	-	-	20.0
4.0	3.8	65.3	63.3	-	-	23.0
10.0	5.9	59.3	57.3	-	-	25.0
16.0	7.5	56.2	54.2	-	-	25.0
20.0	8.4	54.8	52.8	-	-	25.0
31.25	10.5	51.9	49.0	-	-	23.6
62.5	15.0	47.4	45.4	-	-	21.5
100.0	19.1	44.3	42.3	-	-	20.1
250.0	31.1	38.3	36.3	-	-	17.3
350.0	37.2	36.1	34.1	-	-	16.3
400.0	40.1	35.3	33.3	-	-	15.9
500.0	45.3	33.8	31.8	-	-	15.2

NOTE: For ELFEXT and PSELFEXT, follow TIA guidelines for Cat6A.

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test

described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.

5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.13 SYSTEM INTEGRATION AND TESTING

- A. Contractor shall provide to client representative, at contract notice to proceed, a list of all devices and/or locations where equipment is noted on plans as "District" or "Owner" provided. Contractor shall be responsible for coordinating the receipt and safe handling of each piece of equipment until installation is complete.
- B. Equipment provided by the client shall be handled and installed by the Contractor, this may include network switches, Wireless Access Points, Power-Over-Ethernet injectors, security cameras, etc. All equipment shall be installed by the Contractor in their respective locations as shown on the plans.
- C. Upon complete install of the equipment, Contractor shall provide and install appropriate patching of equipment to network infrastructure (Cat 6, Cat 6A, fiber-optic cable, etc.) as necessary to deliver a fully functional network solution.

3.14 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS

- A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this

installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment. The test documentation shall be compatible with common, license-free computer software such as Adobe Acrobat (PDF), or with Microsoft Excel or Word.

- B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.
- C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require to read the test results.
- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 4 - WARRANTY AND SERVICES

4.1 WARRANTY

- A. The manufacturer shall provide the warranty directly to the end-user.
- B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.
- C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.0. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 155Mb/sATM, and 1Gb/s ATM.
- D. The contractor shall provide a warranty on the physical installation.

4.2 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

END OF SECTION 27 13 00

SECTION 28 31 00 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section Includes:

1. Provide a complete, fully addressable, power limited, fire detection and evacuation system as shown on the drawings and/or as required for a complete and operating system. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 5 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72-7-1.
6. Warranty: The equipment and wiring shall be warranted to be free from electrical and mechanical defects for a period of two (2) years commencing with final acceptance by Owner.
7. All Fire Alarm wiring shown in drawings shall be installed in conduit.
8. System Operation shall include:
 - a. Separate zone signaling and device status indication for all initiating devices.

- b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
 - c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
 - d. Supervision of all circuits to indicate any abnormal wiring condition.
 - e. One (1) N.O./N.C. integral relay for external device interface or as indicated on drawings.
 - f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.
9. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
- a. Life safety fire alarm detection and signaling system.
 - b. Furnishing and installation of equipment and devices.
 - c. Conductors, connections and interconnections where specified and all in conduit system.
 - d. Testing, cleaning and adjusting of completed work.
 - e. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
 - f. Complete maintenance for two years. Proposal for subsequent maintenance contract.
 - g. All work and material for complete and operable systems as indicated or specified.
 - h. Permits, inspections and fees.
 - i. Identification and instruction to Owner Representative. Training shall consist of a minimum of two (2) 6-hour sessions.
10. Coordination with Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Furnishing of special back boxes where required for installation of fire alarm devices.
12. All conductors to be installed in conduit pursuant to Specification Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
13. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
14. All initiating devices shall be separately addressed for individual identification at control panel.
15. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
16. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
- a. Instructions for replacing any components of the system, including internal parts.
 - b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
 - c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
 - d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. The submittal shall include certification from the manufacturer verifying that the distributor is an authorized agent, who is qualified and trained by the manufacturer in the proper installation, operation and service of the system.
- C. Shop Drawings:
 - 1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component and CSFM number.
 - 2. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed. Note: It shall be acceptable to provide written acknowledgement that the engineer-prepared approved fire alarm drawings will be used as project fire alarm shop drawings and no exceptions are taken.
 - 3. Include wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
 - 4. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
 - 5. Describe system characteristics and function as well as device wiring diagrams.
 - 6. Voltage drop and battery calculations for each control panel and power supply and initiating circuits.
 - 7. System operational matrix.
- D. Data Sheets: Show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.
- E. Manufacturer's Certificate: Note whether the system meets or exceeds specified requirements.
- F. Operating and Maintenance Instruction Manual:
 - 1. Manual shall include the following tailored to this specific project:
 - a. Operational description.
 - b. Coded cabling plan.
 - c. Two wire circuit diagrams.
 - d. Wiring destination schedule.
 - e. Schematic component diagrams and PC board layouts.
 - f. Maintenance and alignment procedures.
 - g. Voltage drop and battery calculations.

1.4 COORDINATION

- A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit conduit and pathing requirements to electrical installer.

1.5 SYSTEM DESCRIPTION

- A. General: System to be listed by Underwriters Laboratories and the California State Fire Marshal, designed to meet the functional requirements of NFPA 72.
- B. Features:
 - 1. Fire control command center panel with graphic annunciator, printer (where specified) and alarm communicator transmitter (DACT) where specified and/or required.
 - 2. Alarm/trouble point transmitters.
 - 3. Manual alarm reporting stations (addressable).
 - 4. Ionization smoke detectors (addressable).
 - 5. NAC extender panels.
 - 6. Heat detectors (addressable).
 - 7. Combination speaker/visual alarm signal devices.
 - 8. Speaker and audible devices.
 - 9. Visual alarm signal device.
 - 10. Exterior bell.
 - 11. Connection to sprinkler waterflow and pressure switches (addressable).
 - 12. Sprinkler valve supervision (addressable).
 - 13. Provision for connection to off-site central station via leased telephone lines.
 - 14. Control module.
 - 15. Monitor module.
 - 16. Sync. Module.

1.6 SYSTEM OPERATION

- A. System to be the active interrogate/respond type alarm system, 24 volt DC noncoded, positive, non-interfering, successive operation, in which all devices are constantly sending status signals to the main fire control command center from remote data transmitter panels approximately every one second. A change in status to be reported twice to determine that it is a valid signal, and be automatically and permanently recorded.
- B. Wiring, equipment and devices for alarm initiation, annunciation, and audible signaling to be continuously supervised for opens, shorts or grounds (trouble). Each alarm initiating device circuit to be provided with illuminated and audible annunciation of both trouble and alarm conditions. Non-illumination indicates a normal condition.
- C. Any alarm or trouble condition shall sound an audible signal at the fire command center and the remote annunciator. Signal shall be silenced by a momentary contact switch which shall transfer the signal to a visual indicator. Subsequent trouble conditions shall cause the signal to resound and in turn may be silenced. Upon restoration to normal, the trouble signal silencing indicator shall extinguish automatically.
- D. Activation of any automatic or manual alarm initiating device shall cause the following to occur:
 - 1. Sound an audible alarm and illuminate the visual indicator for zone and type of alarm at the fire command center, the remote annunciator and fire alarm control panel.
 - 2. Sound, at building of origin, the audible alarm signal over the system audible devices and activate the visual signal devices.
 - 3. Transmit alarm signal to energy management system for shutdown of building air handler.
 - 4. Transmit alarm signal to the central station office.

- E. System shall not incorporate a time delay for any of the alarm initiating devices. All alarms shall be considered confirmed alarms.
 - F. Detection shall be addressable and reporting of fire conditions to be accomplished by the following basic methods:
 - 1. Smoke detectors.
 - 2. Heat detectors.
 - 3. Waterflow switches.
 - 4. Carbon Monoxide detectors.
 - G. Fire alarm system inputs to be further subdivided as follows, for a more defined indication of the location and nature of the fire or trouble condition:
 - 1. Smoke/heat detector by device and location.
 - 2. Waterflow or pressure switch by device and location.
 - 3. Sprinkler valve position indication by device and location.
 - H. Alarm condition shall override trouble indication. Trouble indication shall reappear after alarm reset.
 - I. Fire Alarm Zones shall be as indicated on drawings.
 - J. Printout on system printer of all alarm and trouble reports, indicating type of device, condition, time and date and alarm clearing.
 - K. Selective manual testing of any device point or zone in the system to determine normal, trouble or alarm status.
 - L. Command center shall have annunciator indicating building floor, room number and zone.
 - M. System shall be capable of manual operation in the event of malfunction of the central processor. Supplier shall include a statement in the system shop drawing submittal explaining the manual operating capability of the system. System shall provide redundant processor capabilities to duplicate primary processor function.
 - N. Operation: All components shall be interconnected in accordance with the manufacturer's instructions to provide a complete and operable system as described.
- 1.7 LOADS OF EQUIPMENT AND COMPONENTS
- A. Follow IEEE Standard where applicable.
 - B. Provide fuse protection for equipment and spare fuses.
 - C. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.
 - D. Operating voltage dissipated by resistors shall not exceed 25% of ratings.
 - E. Operating voltage of capacitors shall not exceed 80% of rated voltage.

- F. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.
- G. Use electronic components of types and rating commonly available from stock of established commercial distribution.

1.8 GUARANTEE

- A. Conform to applicable provisions of the GENERAL REQUIREMENTS.
- B. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.
- C. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.
- D. All component failures shall be remedied to the satisfaction of the Owner.
- E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

PART 2 - PRODUCT

2.1 MATERIALS

- A. Fire Alarm Control Panel (FACP) and system shall be UL listed for power-limited application, (as described on the plans). System shall be as manufactured by Gamewell Fire Control Instruments (FCI).
- B. Peripheral Devices
 - 1. Analog Photoelectric Smoke Sensors (refer to drawings for model number).
 - a. Analog photoelectric sensors shall have a low profile and be capable of being set at five sensitivity settings of "LOW, LOW MEDIUM, MEDIUM, MEDIUM HIGH, and HIGH" levels.
 - b. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke. This method shall test all sensor circuitry and a "Failed Test" indication shall display for any failed test.
 - c. Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that the sensor is receiving power and communication is taking place. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. An alarm output shall be available for remote annunciation.
 - d. The system shall check the sensitivity of each sensor periodically. If a sensor alarm threshold sensitivity has changed, due to again and/or dust accumulation, the system shall automatically compensate for this change (drift compensation).

- e. Each sensor shall allow for the setting of two sensitivity levels. These levels may be programmed so that when the building is occupied, a sensor will be less sensitive than when the building is unoccupied. This feature permits sensors to be more reliable and at the same time reduces/minimizes unwanted alarms. This feature shall also provide for programmable weekend days, where the sensor will remain at an unoccupied sensitivity level.
 - f. The sensor screen and cover assembly shall be removable for field cleaning.
 - 2. Addressable Thermal Sensor (refer to drawings for model number):
 - a. Addressable thermal sensors shall have a low-profile and operate on the combination "rate-of-rise" and "fixed temperature" principals with the fixed temperature set point at 135°F. They shall contain dual thermistor sensing circuitry for fast response.
 - 3. Addressable Subloop Monitor Module (refer to drawings for model number):
 - a. An addressable monitor module with an initiating circuit capable of being configured Class B, Style B. The module shall contain a yellow status LED that shall flash when in a quiescent mode and light continuously when in alarm. The LED shall be field programmable not to provide quiescent status indication, if so desired.
- C. Fire Alarm remote power supply, NAC panel, shall be UL listed for power-limited application. Provided with (4) four-signal circuits minimum capacity or as required to make system fully operational with an output current of 6 to 9 amps as required for proper operation.
- D. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing:
- E. Fire Alarm terminal cabinet shall be Square D Class 6650. Size as shown on drawings or as required.
- F. Conduit and Wire
 - 1. Conduit
 - a. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
 - b. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 - c. Fire alarm cabling above accessible ceilings may be installed without conduit in "open-wired" fashion. Support labels with J-hooks or similar means.
 - d. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
 - e. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 - f. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
 - g. Conduit shall be 3/4" (19.1 mm) minimum.
 - 2. Wire

- a. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
- b. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- c. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
- d. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
- e. All field wiring shall be electrically supervised for open circuit and ground fault.
- f. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

G. Substitutions

1. The fire alarm System has been designed and approved as a "complete system". Substitute equipment will be approved when the following conditions are met:
 - a. A request for substitution shall be made prior to bid for the Owner's and design team consideration and approval.
 - b. Submit detailed fire alarm plans, specifications and engineering calculations including but not necessarily limited to:
 - 1) CSFM listing #'s and Manufacturer Model #'s for every system component which is to be interconnected as a part of this project.
2. Single line, riser and point to point wiring diagrams including battery and voltage drop calculations for the entire system in compliance with NFPA 72. Indicating appliance shall be calculated on the bases of the highest current rating possible at that device.
3. Indication of conductor type(s), power-limited or non-power-limited system, independent of interconnected to existing system.
4. Submit / obtain approval from the Owner for the entire system.
 - a. The party requesting the substitution shall be responsible for any additional cost acquired during the approval.

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with all applicable paragraphs in Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, apply as though repeated herein.
- B. Install system(s) in accordance with manufacturer's instructions.
- C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative.

3.2 GROUNDING

- A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26, GROUNDING AND BONDING OF ELECTRICAL SYSTEMS.

3.3 INSPECTION

- A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

3.4 LOCATION

- A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

3.5 WIRING

- A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

3.6 TESTING

- A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies.
 - 1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
 - 2. At least on half of all tests shall be performed on battery standby power.
 - 3. Where application of heat would destroy any detector, it may be manually activated.
 - 4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
 - 5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
 - 6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
 - 7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

3.7 REPORT

- A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 31 00

SECTION 31 10 00 – SITE CLEARING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included: Clear and grub the site as shown on the Drawings and specified herein.
- B. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 31 20 00 - Earth Moving.
 - 3. Geotechnical Investigation Report for the project.

1.2 QUALITY ASSURANCE

- A. A Geotechnical Engineer will be retained by the Owner to observe performance of work in connection with Site Cleaning, Grading, Excavation and Fill, Utility, Trenching, Subgrade and Roadbed preparation, and preform compaction tests.
- B. Re-adjust work performed that does not meet technical or design requirements but make no deviation from the contract documents without specific and written approval from the Architect and/or Engineer.
- C. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 – PRODUCTS

2.1. MATERIALS

- A. Provide materials not specifically described but required for proper completion of the work of this Section, as selected by the Contractor subject to the approval of the Architect.
- B. Herbicide – Provide a dry, free-flowing, dust-free chemical compound, soluble in water capable of inhibiting growth of vegetation, and approved for use on this work by governmental agencies having jurisdiction and the Architect.

PART 3 – EXECUTION

3.1. SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions are detrimental to timely and proper execution of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2. PROTECTION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
- C. Protect existing utilities indicated or made known.
- D. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub a sufficient distance away and of sufficient height so trees and shrubs will not be damaged in any way as part of this work.

- E. Protection of persons and property:
 - 1. Barricade open depressions and holes occurring as part of this work, and post warning lights on property adjacent to or within public access.
 - 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.
 - F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
 - G. Maintain access to the site at all times.
- 3.3. CLEARING
- A. Clearing and Grubbing:
 - 1. Remove all surface rocks, trash, tree stumps, roots, and other vegetation within the extent of construction as indicated by the drawings. Do not remove vegetation in other areas.
 - 2. Grub soils to a depth adequate to remove all deleterious material from the working area of the site.
 - 3. Do not leave any root greater than 1" in diameter and larger in the ground to a depth of at least 12" below the existing ground surface or subgrade of the new graded surface, whichever is lower, except as specifically approved by the Engineer. Treat tree roots remaining in the soil with an herbicide approved by the Architect.
 - B. Removal of Debris: Remove all debris from the site in a legal manner and leave the site in a neat and orderly condition subject to the approval of the Owner. Do not store or permit debris to accumulate on the job site.
- 3.4. DISPOSAL
- A. General:
 - 1. Remove brush, grass, roots, trash, and other material from clearing operations.
 - 2. Dispose of trash away from the site in a legal manner.
 - 3. Do not store or permit debris to accumulate on the jobsite.
 - B. Do not burn debris at the site.
- 3.5. DUST CONTROL
- A. At the contractor's expense, use chemical palliative or spread water as required to maintain strict control of dust generated by operation of work under this Section.
- 3.6. CLEAN UP
- A. Maintain cleanliness on roadways and other public area used by equipment. Contractor will be held responsible for immediate removal of all spillage on paving. Remove from the Project Site all rubbish, rubble, and debris found thereon and all materials and debris resulting from demolition, leaving site in a safe and clean condition.

END OF SECTION

SECTION 31 20 00 – EARTH MOVING

PART 1 – GENERAL

1.1. DESCRIPTION

- A. This section includes, but is not necessarily limited to, work necessary or incidental to clearing and grubbing, excavating, grading, filling, and backfilling as shown, described, or reasonably inferred by contract documents.
- B. Geotechnical Investigation Report:
 - 1. A Geotechnical Investigation Report for the site of this work has been prepared. The
 - 2. The recommendations of the Geotechnical Investigation Report are considered a part of the construction documents unless otherwise directed by the Architect and Engineer.
- C. Use of Data:
 - 1. Reports were obtained only for the architect's use in design and are not part of the contract documents except as noted.
 - 2. Reports are available for bidders' information but are not a warranty of subsurface conditions.
 - 3. Bidders should visit the site and acquaint themselves with the existing conditions.
 - 4. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to the site and subsurface conditions, but such investigations shall be performed only under time schedules and arrangements approved in advance by the Architect.
- D. Related Work:
 - 1. Section 31 20 10 - Grading
 - 2. Section 33 00 10 - Trenching, Backfilling, and Compacting.
 - 3. Section 32 12 14 - Subgrade and Roadbed
 - 4. The Geotechnical Investigation Report prepared for this project

1.2. PROJECT / SITE CONDITIONS

- A. GENERAL
 - 1. Use all means necessary to control dust on or near the site resulting from the performance of the work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site.
 - 2. Contractor shall verify existing grades and dimensions before starting any grading operations. If any discrepancy exists, the Engineer shall be notified immediately.
 - 3. Use all means necessary to protect all existing features, products, or items designated to remain, as well as all work of this Section. In the event of damage, repair or replace immediately to the approval of and at no additional cost to the Owner.
 - 4. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub a sufficient distance away to protect feeder root system and of sufficient height so trees and shrubs will not be damaged in any way as part of this work.
 - 5. All existing benchmarks shall be protected and maintained throughout the course of the work. Monuments or stakes disturbed or destroyed during the course of the work shall be re-established without expense to the Owner.

6. Work shall be conducted as to avoid injury to persons and damage to adjacent property. This includes, but is not necessarily limited to:
 - a.) Provide appropriate shoring, bracing, and barriers.
 - b.) Barricade open depressions and holes occurring as part of this work, and post warning lights adjacent to or within public access.
 - c.) Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - d.) Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining washout, and other hazards created by operations under this Section.
7. An effort has been made to define the location of underground facilities within the job site. However, all existing utilities and other underground structures may not be shown on the drawings and their location where shown is approximate. Contractor shall assume sole and complete responsibility for locating all underground utilities and related facilities and for protection of same during the course of construction. Contact DIG ALERT 811 two working days prior to the start of construction for assistance from the respective utilities. All utilities not a member of U.S.A. must also be notified.
8. Any hauling permits required by the local jurisdiction must be obtained and paid for under this contract. Off-site, all local codes and ordinances must be followed.
9. Maintain access to the site at all times.
10. Erosion control: Erosion control devices shall be provided and available on-site. The contractor is responsible for the placement of such devices, at no cost to the Owner, as directed by the Erosion Control Plan.
11. The contractor is responsible for the cost and acquisition of any necessary storm water permits through the Regional Water Quality Control Board and installation and compliance with the permit.

1.3. PROTECTION AND SAFETY

A. General:

1. Perform all work in accordance with all current regulations, including safety requirements of the California Administrative Code, Title 8 and California Labor code, Div. 5, Part 3.
2. Comply with all current regulations of the Federal Occupational Safety and Health Act (OSHA).

1.4. QUALITY ASSURANCE

- A. General: Equipment and methods used shall be subject to the Geotechnical Engineer's inspection, test, and approval.
- B. Samples: Samples of all materials used shall be supplied and submitted for the Geotechnical Engineer's approval wherever specified or as directed by the Soils Report.

- C. Testing:
1. The Owner will retain and pay a qualified Geotechnical Engineer to observe performance of work in connection with Site Clearing, Excavation and Fill, Utility Trenching, Subgrade and Roadbed preparation and to perform compaction tests. The Geotechnical Engineer shall take all field samples and do all laboratory testing necessary to ensure compliance of the work to these Specifications or as required by the Architect or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Engineer, and Contractor.
 2. Notify testing lab a minimum of 48 hours in advance of testing required to satisfy requirements of this section.
 3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.
- D. Certification Upon Completion of the Work: Contractor shall certify in writing to the Owner and the Engineer that all earthwork was performed in accordance with this specification and as shown on drawings.

1.5. REFERENCE

- A. General:
1. In addition to complying with all current, applicable codes and regulations, including Chapter 18 of the 2022 California Building Code, Title 24, Part 2, comply with applicable sections of:
 - a.) The geotechnical recommendation of the Geotechnical Investigation Report for this project.
 2. All of the above specifications shall be consulted. The most restrictive specification shall apply.

PART 2 – PRODUCTS

2.1. FILL MATERIAL FOR SUB-GRADE PREPARATION

- A. Refer to Section 33 00 10 - Trenching, Backfilling, and Compacting.
- B. Refer to Section 32 12 14 - Subgrade and Roadbed.

PART 3 – EXECUTION

3.1. SITE CONDITIONS

- A. Inspection of site: The Contractor shall prior to the bid, visit the site and determine for himself the existing conditions, nature of materials to be encountered, and all other factors concerning or affecting the work to be done under the Section.
- B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions are detrimental to timely and proper elimination of the work. Do not proceed until unsatisfactory conditions are corrected.
- C. Contractor shall verify, in the field, all elevations, flow lines, points of connections. Any discrepancies shall be called to the Architect's attention before proceeding with the work.

3.2. SITE CLEARING

- A. Refer to Section 31 10 00 - Site Clearing.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 31 20 10 – GRADING

PART 1 – GENERAL

1.1. DESCRIPTION

- A This Section includes, but is not necessarily limited to compaction and grading the site to the elevations shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.
- B Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Sections 31 20 00 - Earth Moving
 - 3. Geotechnical Investigation Report and Geotechnical Engineer

1.2. QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the soils engineer.
- D. The standard tests used to determine maximum dry density and field density shall be ASTM D1557-07 and ASTM D6938-07b respectively.

PART 2 – PRODUCTS

2.1 TOPSOIL

- A. Where and if shown on the Drawings or otherwise required, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life and reasonably free from subsoils, roots, heavy, or stiff clay, stones larger than 2" in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter.
- B. Obtain topsoil from sources within the project limits, or provide imported topsoil obtained from sources outside the project limits, or from both sources.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

- A. Comply with pertinent provisions of Section 32 00 10 - Field Engineering.

3.3 PROCEDURES

- A. Utilities:
 - 1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
 3. If service is interrupted as a result of Work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.
 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.
 - B. Protection of Person and Property:
 1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.
 - C. Dewatering
 1. Remove all water, including rainwater, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
 2. Keep excavations and site construction are free from water.
 - D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- 3.4 COMPACTING
- A. Control soil compaction during construction to provide the minimum percentage of maximum dry density and field density specified for each area as determined according to ASTM M1557-07 and ASTM D6938-07b respectively.
 - B. Provide not less than the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material in place as approved by soils engineer.
 1. Structures:
 - a) All compact soils beneath the proposed new building section shall be compacted to a minimum 95% of maximum density.
 2. Lawn and Unpaved Areas:
 - a) Compact the top 8" of subgrade and each layer of fill material or backfill material at 90% of maximum density.
 3. Walks:
 - a) Compact the top 12" of subgrade and each layer of fill material or backfill material at 90% of maximum density.
 4. Pavements:
 - a) Compact the top 12" of subgrade and each layer of fill material or backfill material at 95% of maximum density for cohesive soil material.
 - C. Moisture Conditioning and Control:
 1. "Moisture conditioning" refers to the moistening or drying of soils to at least optimum moisture content, prior to application of compactive effort.

2. Where subgrade or layer of soil materials must be moisture conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface, during or subsequent to compacting operations.
3. Remove and replace or scarify and air dry soil material that is too wet to permit compacting to the specified density.
4. Soil material that has been removed because it is too wet to permit compacting, may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Geotechnical Engineer.

3.5 DRAINAGE CONTROLS

- A. Provide all necessary temporary apparatus, pumps, curbs, or ditches as required to divert or convey water from any source away from the work. Do not allow water from any source to accumulate within or damage earthwork.

3.6 FINISH SITE GRADING/PROTECTION

- A. General:
 1. Grade all surfaces on the site where indicated and within the construction areas to elevations indicated and as required to insure proper drainage and disposal of surface water. Shape grades to drain away from buildings at minimum 2% slope, as shown on drawings, or as directed by the Geotechnical Engineer.
 2. After grading is completed, and the Geotechnical Engineer has finished his observation of the work, no further excavation or filling shall be done except with the review of, and under the observation of, the Geotechnical Engineer.
 3. It shall be the responsibility of the Contractor to prevent erosion of the freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.7 TOLERANCES

- A. Earthwork
 1. All rough grading shall be placed to a vertical tolerance of plus or minus one tenth (.1) foot.
 2. All rough grading shall be placed to a horizontal tolerance of plus or minus one half (.5) foot.

3.8 FIELD QUALITY CONTROL

- A. Secure the Geotechnical Engineer's inspection and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- B. Provide at least the following tests to approval of the soils engineer:
 1. At paved areas, at least one field density test for every 2000 sq. ft. of overlaying paved area, but not less than three tests.
 2. In each compacted fill layer, one field density test for every 2000 sq. ft. of overlaying paved area, but not less than three tests.
- C. If, in the Geotechnical Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing under the provisions of Section 01 40 00 of these Specifications.

3.9 MAINTENANCE

- A. Protection of Newly Graded Areas:

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

1. Protect newly graded areas from traffic and erosion and keep free from trash and weeds.
 2. Repair and re-establish grades in settled, eroded, and rutted areas to the specified tolerances.
- B. Where completed compacted area are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.
- 3.10 CERTIFICATION
- A. Upon completion of this port of the Work, and as a condition of its acceptance, deliver to the Architect as written report from the soils engineer certifying that the compaction requirements have been obtained. State in the report the area of the fill or embankment, the compaction density obtained, and the type or classification of fill material placed.

END OF SECTION

SECTION 32 00 10 – FIELD ENGINEERING

PART 1 - GENERAL

1.0 SUMMARY

- A. Section Includes: Quality Control, Survey References Points, Submittals, and Project Record Documents.

1.1. DESCRIPTION

- A. Work included: provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
 - 1. Establishing and maintaining lines and levels.
 - 2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.
- B. Related Documents:
 - 1. Bid Proposal
 - 2. Contract General Conditions
 - 3. Supplementary General Conditions
 - 4. Section 01 10 00 - Summary
 - 5. Section 01 33 00 - Submittal Procedures
 - 6. Section 01 44 00 - Quality Requirements
 - 7. Section 01 77 00 - Closeout Procedures

1.2. QUALITY ASSURANCE

- A. The Contractor is solely responsible for the complete, timely, and accurate layout of the work including, but not necessarily limited to, horizontal and vertical control and dimensional coordination as necessary to construct the work in accordance with the Contract Documents.
- B. Employ a Land Surveyor or a Civil Engineer, registered in the State of California to perform survey work.
- C. Employ a Professional Engineer of the discipline required for specific service on the project and licensed in the State of California where required in the technical specifications.

1.3. SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points are shown on the Contract Documents.
- B. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.
 - 1. Make no changes or relocations without prior written notice to Architect.
 - 2. Report to Architect when any reference point is lost or destroyed.
 - 3. Contractor is responsible to hire a surveyor to replace or re-establish project control points, which may be lost or destroyed at no additional cost to the District.
- C. Establish replacements based on original survey control.

1.4. PROJECT SURVEY REQUIREMENTS

- A. Establish and maintain lines and levels, locate and lay out:
 - 1. Site Improvements
 - a) Stakes for grading, fill, and topsoil replacement.
 - b) Utility slopes and invert elevations.
 - 2. Batter boards for structures.
 - 3. Building foundations, column locations, and floor levels.
 - 4. Controlling lines and level required for mechanical and electrical work.
- B. From time to time, verify layouts.

1.5. SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Submit, name, address, and telephone number of Surveyor before starting survey work.
- C. If requested by Architect, submit documentation to verify accuracy of field engineering work.
- D. Submit certificate signed by the Engineer or Land Surveyor, licensed to practice in the State of California, certifying that elevations and locations of improvements are in conformance with the requirements of the Contract Documents, or if in non-conformance, and explanation of the discrepancy.

1.6. PROCEDURES

- A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities.
 - 1. Locate and protect control points before starting work on the site.
 - 2. Preserve permanent reference points during progress of the Work.
 - 3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
 - 4. Promptly advise the Architect when a reference point is lost or destroyed or requires relocation because of other changes in the Work.
 - a) Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
 - b) Locate such replacements according to the original survey control.

1.7. PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. Upon completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
- C. Submit Record Documents under provisions of Section 01700 – Project Closeout.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

SECTION 32 12 14 – SUBGRADE AND ROADBED

PART 1 – GENERAL

1.1. DESCRIPTION

- A. This section includes, but is not necessarily limited to the work necessary for the preparation of the subgrade.
 - 1. The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, parking lots, sidewalks, or other places upon which additional materials are to be placed under Contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with Section 31 20 00 – Earth Moving, and as provided herein.

1.2. RELATED WORK DESCRIBED ELSEWHERE

- A. All underground work in the area of the subgrade shall be completed and properly backfilled before subgrade work is started. This is intended to include work on the Contract, work to be performed by the School District, or by others.
- B. These Specifications are to be used in conjunction with requirements in those sections of the Specifications having to do with specific types of base materials and pavements.
 - 1. Section 31 10 00 - Site Clearing
 - 2. Section 31 20 00 - Earth Moving
 - 3. Section 32 12 15 - Aggregate Base
 - 4. Section 32 12 16 - Asphalt Paving
 - 5. Section 32 13 13 - Concrete Paving

PART 2 – PRODUCTS

2.1. EXCAVATION AND ENBANKMENT

- A. The excavation shall include removal of materials which are encountered in excavating to the required grades, including existing pavements and curbs designated to be removed, or as required to accomplish the construction.

2.2. EQUIPMENT

- A. Furnish all necessary equipment required to accomplish the excavating, shaping, grading and rolling, and compaction specified herein.

PART 3 – EXECUTION

3.1. SUBGRADE

- A. Excavate and shape subgrade to line, grade, and cross section. Roll subgrade with an approved roller until the top 12 inches is compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 1557. Remove all soft or otherwise unsuitable material disclosed by the rolling and replace with suitable material from the excavation. Fill holes, and depressions which develop under the roller, to the required grade and cross sections with material from the excavation. The finished subgrade shall be within a tolerance of plus or minus 0.10 of a foot of the grade and cross section shown. The subgrade shall be smooth and free from irregularities and at the specific density. Compaction shall extend one foot beyond the edge of paving, curb, or form work.
- B. The Contractor shall be responsible for the protection of existing improvements, any damage resulting from his operations shall be the Contractor's sole responsibility.

3.2. EXCAVATION BELOW GRADE

- A. Where a Geotechnical Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as necessary to remove the unsatisfactory material. Excavation below grade shall be of the same classification as that above it, provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the excavation, and is required to remove additional, unsuitable material beyond the scope provided in these specifications, or where additional depth requires special equipment because of unforeseen conditions, the work shall be performed and a payment for excavation below grade will be made on the basis of extra work as provided in the Contract.
- B. If the excavation below grade is required because of negligence on the part of the Contractor, the necessary excavation below grade and the backfilling required to restore the surface satisfactorily shall be at the Contractor's sole expense.
- C. The subgrade shall be sprinkled with water as required, and in such quantities as necessary, to obtain the specified compaction.

3.3. PROTECTION OF SUBGRADE

- A. After preparing the subgrade as above specified, all unnecessary traffic shall be kept off. Should it be found necessary to haul over the prepared subgrade, the Contractor shall grade and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All ruts, cuts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.
- B. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross section. Will not be permitted. The contractor shall protect the prepared subgrade from both construction and public traffic.
- C. The subgrade shall be maintained in the finished conditions until the first succeeding source is placed.

3.4. DRIVEWAYS

- A. Excavate and shape driveways to the lines, grades, and cross sections shown, or as determined in the field by the Engineer.

END OF SECTION

SECTION 32 12 15 – AGGREGATE BASE

PART 1 –GENERAL

1.0 SUMMARY

- A. Section includes: This section covers the materials and work necessary for construction of aggregate base, as specified, complete.
- B. Related Sections:
 - 1. See Division 1 – General Requirements, which contain information and the requirements that apply to the work specified herein.
 - 2. Section 32 12 14 - Subgrade and Roadbed
 - 3. Section 32 12 16 - Asphalt Paving
 - 4. Section 32 13 13 - Concrete Paving
 - 5. The Geotechnical Investigation Report and the Geotechnical Engineer.

1.1 SUBMITTALS

- A. Samples and Testing: At least thirty (30) days prior to the use thereof, the Contractor shall submit to the Geotechnical Engineer a sample of aggregate, graded as intended for use. Provide sample size as directed by the Geotechnical Engineer, not to exceed 120 lbs. This requirement shall be complied with for each aggregate and grading thereof that has not been reviewed. The Geotechnical Engineer will test the sample at no cost to the Contractor, and will determine the acceptability of the aggregate.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate: The aggregate shall be free from vegetable matter and other deleterious substances. Aggregate for aggregate base shall consist of material of which at least 60 percent by weight shall be crushed particles as determined by Test Method No. Calif. 205.
 - 1. The percentage composition by weight of aggregate base shall conform to one of the following gradings when determined by Test Method No. Calif. 202.
 - 2. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.

Percentage Passing		
	1-1/2"	3/4"
Sieve Size	Maximum	Maximum
2-Inch	100	
1-1/2-Inch	90-100	
1-Inch		100
3/4-Inch	50-85	90-100
No. 4	25-45	35-60
No. 30	10-25	10-30
No. 200	2-9	2-9

3. The aggregate base shall also conform to the following quality requirements:

	Test Method		
Tests	No. Calif		Requirements
Resistance (R-Value)*	301	78	Minimum
Sand Equivalent	217	22	Minimum
Durability Index	229	35	Minimum

4. The aggregate shall not be treated with lime, cement, or other chemicals before the Durability Index test is performed.
5. Material yielding a maximum dry density of less than 112 pounds per cubic foot when tested in the laboratory in accordance with ASTM "Standard Methods of Test of Moisture-Density Relations of Soils, Using 10-Pound Rammer and 18-Inch Drop", Designation D 1557, shall not be used.
6. Any rock, including red rock, meeting all the requirements of this Section will be acceptable. Such rock shall be plant processed at an approved processing plant.

2.2 EQUIPMENT

- A. Furnish all necessary equipment required to accomplish the spreading, shaping, and compaction required.

PART 3 – EXECUTION

3.1 SUBGRADE

- A. Proof roll subgrade immediately prior to commencement of spreading of aggregate base. Make necessary repairs as directed by the Geotechnical Engineer OR as described in Section 321214 - Subgrade and Roadbed

3.2 DELIVERY AND SPREADING

- A. Aggregate base material shall be delivered to the roadbed as uniform mixtures; each layer shall be spread in one operation.
- B. At the time aggregate base is spread it shall have a moisture content sufficient to obtain the required compaction. Such moisture shall be uniformly distributed throughout the material.
- C. The material shall be spread upon the prepared subgrade by means of vehicles equipped with approved spreading devices at a uniform quantity per linear foot, which quantity will provide the required compacted thickness within the tolerances specified.
- D. Depositing and spreading shall commence at that part of the work farthest from the supply of base material and shall progress continuously without breaks, unless otherwise directed by the Geotechnical Engineer.
- E. Where the required thickness is six inches or less, the base material may be spread and compacted in one layer. Where the required thickness is more than six inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed six inches. Each layer shall be spread and compacted in a similar manner.

- F. Base materials placed in areas inaccessible to the spreading equipment may be spread in one or more layers by any means that will make possible the specified compaction and surface.
- G. When the subgrade for the aggregate base consists of cohesionless sand, and written permission is granted by the Geotechnical Engineer, the base materials may be dumped in piles upon the subgrade and spread ahead from the dumped material.
- H. The base materials, after spreading, shall be shaped by means of blade grader to such thickness that after watering and compacting, the completed base will conform to the required grade and cross section within the tolerances specified.
- I. Segregation of aggregate shall be avoided; the base shall be free from pockets of coarse or fine material.

3.3 COMPACTION

- A. Immediately following spreading, shaping, and smoothing, the full width of the base material shall be watered as ordered by the Geotechnical Engineer, and compacted by rolling with a minimum of two pieces of self-propelled reversible equipment. Compaction shall be as follows:
 - 1. For initial rolling use a 3-wheel steel-tired roller, weighing not less than 12 tons distributed so that the rear wheels will apply to the surface being rolled not less than 325 pounds per linear inch of rear tire width. Rolling shall commence by covering completely the outer edge of the material. Subsequent passes shall lap at least 25 percent on previously rolled material.
 - 2. For subsequent rolling use a pneumatic-tired roller of the oscillating type, having a width of not less than four feet and equipped with tires of equal size and diameter. Wobble wheel rollers will not be permitted. The tires shall be so spaced that the entire gap between adjacent tires will be covered by the tread of the following tire. The tires shall be inflated to 90 pounds per square inch minimum.
 - 3. To compact all areas inaccessible to the rollers, use compressed air or gas-powered tampers.
- B. The foregoing equipment requirements serve as a standard of adequacy.
- C. Subject to the condition that the Contractor shall notify the Geotechnical Engineer at least ten (10) days in advance and shall secure approval for the use of each piece of compacting equipment other than that specified, selection thereof, and obtainment of the specified compaction throughout the volume of base and the specified surface shall be solely the responsibility of the Contractor.
- D. If compaction is not uniform or tests show to be inadequate, or if the surface is unsatisfactory, the Geotechnical Engineer may require the use of other or additional equipment.
- E. Should low or high spots develop during rolling operations, such spots shall be smoothed by blading with a self-propelled, pneumatic-tired motor grader having a wheelbase not less than 15 feet long and a blade less than 10 feet long.
- F. Aggregate base shall be watered after compaction. Water shall be applied at the rate and in the quantities ordered by the Geotechnical Engineer.
- G. The relative compaction of aggregate base, determined by tests of the in-place, field compacted base shall not be less than 95 percent if the maximum compaction at optimum moisture content determined by the ASTM Methods of Test, Designation D 1556 and

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

Method C of Designation D 1557. The tests will be conducted and evaluated in the laboratory by the Geotechnical Engineer at no cost to the Contractor.

- H. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below proper grade; such surface shall contain no ridges, valleys or sharp breaks.
- I. Finished base that does not conform to the foregoing requirements shall be reshaped or reworked, watered, and thoroughly recompact to conform thereto.
- J. The Contractor shall not allow any completed untreated rock base to be subject to public or construction traffic, except the latter necessary to the completion of the overlying surface courses.

END OF SECTION

SECTION 32 12 16 – ASPHALT CONCRETE PAVING

PART 1 – GENERAL

1.0 SUMMARY

- A. Section Includes: This section covers the work necessary for construction of the asphalt concrete leveling course and surface course used for paving roadways and parking areas, and the repair and replacement of existing pavement that has been disturbed by trenching or other construction.
- B. Related Sections:
 - 1. See Division 1 – General Requirements, which contain information and requirements that apply to the work specified herein.

1.1 SUBMITTALS

- A. Submittals during construction shall be made in accordance with Division 1, General Requirements.
- B. Product date: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

1.2 QUALITY ASSURANCE

- A. Standards: The following shall form a part of this specification and shall have the same force as if reproduced in total herein:
 - 1. Standard Specifications.
 - 2. Materials Manual of Testing and Control Procedures, State of California, Business and Transportation Agency, Department of Transportation, herein after referred to as "Materials Manual".
 - 3. ASTM D 1557 shall be used for the method of performing compaction tests.

PART 2 – PRODUCTS

2.1 ASPHALT

- A. Asphalt concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant:
 - 1. Asphalt concrete shall be as required by jurisdiction.
 - 2. Grade of asphalt shall be AR-4000 or AR-8000 as required.
 - 3. Density shall be 95% of maximum laboratory density as determined by California Test Method 304.
 - 4. Stability shall be 30 minimum.
 - 5. Mineral aggregate shall be Type B, 1/2-inch maximum size aggregate, medium grading, and shall conform to the following requirements:

- a) The particle size distribution shall be in accordance with the grading specified for 1/2-inch maximum size aggregate.

<u>Sieve Size</u>	<u>Maximum Percentage Passing</u>
3/4-Inch	100
1/2-Inch	95-100
3/8-Inch	80-85
No. 4	54-64
No. 8	38-48
No. 30	20-30
No. 200	3-8

6. Drying, proportioning, and mixing of the materials shall conform to Section 39 of the Standard Specifications.

- B. Slurry Seal Coat shall be Type II slurry seal and shall be a one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of manufacturer to the Engineer.
- C. Seal Coat shall be equal to SS1H one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of the manufacturer to the Engineer.

2.2 AGGREGATE

- A. Aggregate base shall conform to the provisions of Section 32 12 15 – Aggregate Base and as provided herein.
1. The grading of the aggregate shall be "1/2-inch Maximum, Medium" as described hereon, except in conform or overlay areas, the grading shall be 3/8-inch maximum.
- B. Sampling and testing will not be required. The Contractor shall provide test results as indicated in this section.

2.3 COMPOSITION OF MIXTURE

- A. At least thirty (30) days prior to producing any of the mixture for use in the paving, the Contractor shall submit to the Engineer for approval a job – mix formula which meets the requirements herein specified. No asphalt pavement work shall be undertaken by the Contractor until the Engineer has reviewed the job – mix formula.
- B. The Contractor shall be responsible for locating an acceptable source of aggregate. All tests confirming the suitability of the material for the purpose intended shall be obtained by the Contractor at the Contractor's expense. Certified copies of the aggregate test results from an independent testing laboratory shall be furnished to the Engineer for review at least one week prior to delivery of aggregate to site or use of aggregate in asphalt concrete.
- C. The Contractor shall make arrangement and pay for preparation of the asphalt concrete job mix formula. The job-mix formula for the asphalt concrete mixture shall establish the percentage of aggregate passing each sieve size, and the percentage of bituminous material to be added to said aggregate, and the temperature at which test results from a qualified, independent testing laboratory confirming the job-mix formula shall be submitted by the Contractor to the Engineer for review at least two weeks prior to the start of asphalt concrete paving. Any proposed deviations from the original job - mix formula shall be resubmitted

by the Contractor for review. Test results of aggregate used in asphalt shall be provided as indicated in this section.

- D. The job - mix formula shall indicate the gradation of each of the several aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.
- E. After a job - mix formula is established and reviewed, all mixtures furnished under this Contract shall conform to the requirements and tolerances as stated in these Specifications.

2.4 WEED CONTROL

- A. Spray applied herbicide, currently approved for designated use by all applicable agencies, including air pollution control jurisdiction.

PART 3 – EXECUTION

3.1 PREPARATION OF ROADWAY

- A. Subgrade shall be fine graded per Section 31 20 00 – Earthwork and Section 32 12 14 – Subgrade and Roadbed. The finished subgrade shall be tested and approved by the Geotechnical Engineer prior to the placement of aggregate base.
- B. Thoroughly blend base course aggregate on the job site. Construction shall conform to applicable portions of Section 26 of Standard Specifications. Base material shall be placed, watered as required, and mechanically compacted until a relative compaction of 95% has been obtained for the entire thickness of the base. Each layer of the base course shall be tested and approved by the testing laboratory prior to the placement of successive layer. Compacted base thickness shall be as indicated on the drawings.
- C. Apply herbicide chemical to all areas to receive paving in strict accordance with the printed instructions of the manufacturer. Take all necessary safety precautions to protect against damage or injury due to its poisonous nature. No weed-control chemical is to be applied to areas designed for planting.
- D. A tack coat of asphalt applied at the rate of 0.05 to 0.12 gallons per square yard shall be applied uniformly to all surfaces on which any course of asphalt concrete is to be placed.
- E. The tack coat shall be emulsified asphalt. The emulsified asphalt may be mixed with water at the rate of 1 to 2 parts water to 1 part of emulsified asphalt.
- F. Preparation of Untreated Roadway:
 - 1. A prime coat shall be applied over the full length of the project and asphalt concrete pavement shall not be placed until the prime coat has been cured.
 - 2. Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched with asphalt concrete immediately in advance of placing the asphalt concrete. The Contractor shall maintain the completed prime coat by blading or brooming with motor patrol graders, until the asphalt concrete is placed.
 - 3. After the maintenance, patching or repair work has been completed and immediately prior to placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust or other foreign matter.

3.2 ASPHALT CONCRETE PAVEMENT

- A. The proportioning and mixing of asphalt concrete shall conform to the provision provided herein. The pounds of asphalt per 100 pounds of dry aggregates shall not vary by more than 5% above or 10% below the amount indicated in the job-mix formula. This requirement shall apply to samples taken from a single batch, successive batches, at different locations in the production plant, or at any location on the construction site.
- B. Paint binder shall be applied in conformance with the provisions provided herein.
- C. Spreading equipment and methods shall conform to the provision provided herein. No asphalt concrete shall be placed on any section of compacted aggregate base that has not been reviewed by the Geotechnical Engineer.
- D. The asphalt concrete shall be compacted in accordance with the provisions provided herein. The weight and pressure of the Contractor's pneumatic-tired roller will be reviewed, but not designated or approved, by the Geotechnical Engineer.
- E. Confirm areas associated with placement of asphalt concrete conform to the provisions provided herein.

3.3 PLACEMENT OF ASPHALT CONCRETE PAVING

- A. Install the specified curbs, headers and stakes, to achieve the arrangement of paving shown on the drawings. All unconfined edges shall be confined with 2 inch by 4 inch redwood header boards staked with a 1 inch by 3 inch redwood stake 18 inches long minimum at 6 feet on-center. Two 1 inch by 4 inch pieces may be installed together for bending along curves. Offset all joints by 2 feet.
- B. Remove all loose materials from the compacted base.
- C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations as approved by the Engineer.
- D. Asphalt paving shall be installed in minimum lifts of 2 inches.
- E. Adjust frames, covers and utility vaults, if so required, to meet final grades.
- F. Do not accept receipt or asphalt concrete materials unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees Fahrenheit.

3.4 CONNECTIONS WITH EXISTING FACILITIES

- A. Where it is necessary to remove existing asphalt surfaces or oil mat surfaces to provide proper meet lines and riding surfaces, the Contractor shall burn or chip the existing surface so that there will be sufficient depth to provide a minimum of one inch of asphalt concrete, and the waste material shall be disposed of to the satisfaction of the Engineer and Federal, State and Local Ordinances. Prior to placing the asphalt concrete these areas shall be tacked. Meet lines shall be straight and the edges vertical. The edges of meet lines cut shall be painted with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, the meet lines shall be sealed by painting with a liquid asphalt or emulsified asphalt and immediately covered with clean, dry sand.
- B. Prior to laying down the second strip of asphalt concrete pavement, the edge of the first strip laid and other contact surfaces such as curbs, manhole frames, and similar materials shall be painted with emulsified asphalt or liquid asphalt to provide closely bonded watertight joints. This work shall be done in a manner that will prevent staining adjacent surfaces not intended to be coated.

3.5 COMPACTION

- A. Rolling shall continue until all roller marks are eliminated and a minimum density of 140 pcf has been obtained.
- B. Field density tests shall be made by a commercial testing laboratory retained by the Owner, and the test results submitted to the Geotechnical Engineer for review.

3.6 JOINTS

- A. The placing of the top or wearing course shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued for such length of time as to permit the mixture to become chilled.
- B. When the work is resumed the previously compacted mixture shall be cut back to produce a slightly beveled edge of the full thickness of the course. The material which is cut away shall be wasted and the new mix shall be laid against the fresh cut. Rollers or tamping irons shall be used to seal the joints.

3.7 SURFACE TOLERANCE

- A. Tests for Conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be immediately corrected by the removal or addition of materials and by continuous rolling.
- B. The completed surface of the top of wearing course shall be of uniform texture, smooth, uniform as to crown and grade and free from defects of all kinds. The completed surface shall not vary more than 1/8 inch from the lower edge of a 10-foot straight edge placed on the surface parallel to the centerline.
- C. After completion of the final rolling, the smoothness and grade of the surface shall again be tested by the Contractor.
- D. When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by the addition of asphalt concrete mixture of an appropriate class to low places or the removal of material from high places by methods satisfactory to the Engineer, or by removal and replacement of the wearing course asphalt concrete. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.
- E. All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described above shall be removed and replaced to the satisfaction of the Engineer.
- F. All costs involved in making the corrections of defects described above shall be borne by the Contractor and no compensation will be made for this work.

3.8 APPLICATION OF SEAL OR SLURRY COAT

- A. Areas that have received new AC shall have a minimum of 30 day cure time prior to application of either seal or slurry coat. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Geotechnical Engineer.
- B. Apply one coat of the specified sealer.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges and other surface irregularities.

3.9 SAMPLES

- A. The contractor shall, without additional charge, provide the Geotechnical Engineer with test results of samples of asphalt concrete cut from the completed pavement or the individual courses thereof. The minimum number of tests cores shall be two per day during paving. The number of cores shall be increased if problems are indicated. The contractor shall also provide the Geotechnical Engineer with test results or samples of the uncompressed asphalt concrete mixtures, and all materials incorporated in the work.

3.10 UNFAVORABLE WEATHER

- A. Asphalt for prime coat shall not be applied when the ground temperature is lower than 50 degrees F without written permission of the Geotechnical Engineer.
- B. Asphalt concrete shall not be placed when the atmospheric temperature is less than 40 degrees F nor during heavy rainfall.

3.11 ALLOWABLE TOLERANCES

- A. Surface Smoothness:
 - 1. The surface of the finished base course shall not vary more than 3/8 inch, plus or minus, in 10 feet.
 - 2. The surface of the finished asphalt concrete shall not vary more than 1/4 inch, plus or minus, in 10 feet.
- B. The compacted paving or base course thickness shall not vary more than 1/4 inch plus or minus, based on an average of five (5) measurements per 10,000 square feet, taken at randomly selected locations by testing laboratory.
- C. Provide hot plant mixed asphalt concrete paving materials.
 - 1. Temperature leaving the plants shall be 290 degrees Fahrenheit minimum, 320 degrees Fahrenheit maximum.
 - 2. Temperature at time of placing shall be 280 degrees minimum.

3.12 SURFACE FINISH

- A. Surface finish shall be uniform and consistent in color and texture throughout the extents of the project and shall be achieved, at a minimum, by applying a slurry coat.

END OF SECTION

SECTION 32 16 00 – CONCRETE CURBS, GUTTERS AND SIDEWALKS

PART 1 – GENERAL

1.1. DESCRIPTION

- A. Section includes: This section covers the work necessary to completely construct the concrete curbs, gutters and sidewalks.
- B. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications
 - 2. Section 32 13 13 – Concrete Paving

1.2. SUBMITTALS

- A. Submit Product Information and Mix Design, Certification, Test Results, and Source of Expansion Joint Filler.

PART 2 – PRODUCTS

2.1. FORMS

- A. Materials for curb and gutter shall be 2-inch dressed dimension lumber or of metal of equal strength, free from defects which would impair the appearance or structural quality of the completed curb. Where short-radius forms are required, 1-inch dressed lumber or plywood may be used. Form material for the face of the curb shall not have any horizontal joints closer than seven inches from the top of the curb. Provide stakes and bracing materials as required to hold forms securely in place. Metal forms shall be subject to approval of the Engineer.
- B. Materials for sidewalks shall be 2-inch dressed dimension lumber, straight and free of defects, or standard metal forms. Where short radius forms are required, 1-inch dressed lumber or plywood may be used. Provide stakes and bracing material as required to hold forms securely in place.

2.2. CRUSHED ROCK BASE

- A. Clean 3/4 inch minus crushed rock or crushed gravel, free from foreign material and meeting the requirements of Section 32 12 15 – Aggregate Base.

2.3. EXPANSION JOINT FILLER

- A. Expansion joint filler shall be 1/2 inch thick, pre-molded joint filler material. It shall consist of pre-molded strips of a durable resilient material. Pre-molded joint filler shall be one of the following:
 - 1. Preformed Expansion Joint Filler (Bituminous) conforming to ASTM D 994.
 - 2. Non-extruding and Resilient Filler (Bituminous) conforming to ASTM D 1751.
 - 3. Approved equal.

2.4. CONCRETE

- A. Concrete shall be ready mixed, conforming to ASTM C 94, Alternate 2, and shall have a compressive strength of 2,500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inch. Slump shall be between two and four inches. Submit complete information regarding mix to the Engineer for review, in accordance with the requirements of the referenced ASTM Specifications.

2.5. CURING COMPOUND

- A. Liquid membrane-forming curing compound shall be clear or translucent, suitable for spray application and shall conform to ASTM C 309, Type 1.

2.6. ACCEPTANCE OF MATERIALS

- A. All materials shall be subject to inspection for suitability as the Engineer may elect, prior to or during incorporation into the work.

PART 3 – EXECUTION

3.1. EXCAVATION AND BACKFILL

- A. Perform all excavation and backfill required to accomplish the construction. After concrete forms have been removed and all debris cleaned up from the areas to be filled, placed backfill from excavation in six inch lifts to grade and compact each lift thoroughly with pneumatic tamper or other suitable equipment to prevent future settlement. Dispose of all excess excavation offsite.

3.2. PREPARATION OF SUBGRADE

- A. Bring the area on which curbs, gutters, and sidewalks to be constructed to required grade on undisturbed ground and compact by sprinkling and rolling or mechanical tamping. As depressions occur, refill with suitable materials and recompact until the surface is at the proper grade. Subgrade shall be compacted to 95% of maximum density at optimum moisture content as determined by ASTM M 1557, Method C.

3.3. SETTING FORMS

- A. Construct forms to the shape, lines, grades and dimension called for on the Drawings. Stake wood or steel frames securely in place, true to line and grade.
- B. Forms on the face of the curb shall not have any horizontal joints within seven inches of the top of the curb. Brace form to prevent change of shape or movement in any direction resulting from the weight of the concrete during placement. Construct short radius curved forms to exact radius. Tops of forms shall not depart from gradeline more than 1/8 inch when checked with a 10 foot straight edge. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.

3.4. CURB CONSTRUCTION

- A. Construct curbs to line and grade shown or established by the Engineer. Curbs shall conform to the detail shown.
- B. Ramps shall be constructed at pedestrian crossings as shown in conformance with the legal requirements.
- C. Place preformed asphalt impregnated expansion joints at intervals not exceeding 40 feet and at the beginning and end of curved portions of the curved portions of the curb; also at connections to existing curbs.
- D. Place weakened plane joints in the curb at intervals not exceeding 10 feet. Place, process, finish, and cure concrete in accordance with the applicable requirements of ACI 614, and the Specification. Wherever the requirements differ, the higher shall govern. After initial set has occurred in the concrete and prior to removing the front curb form, the steel sheet shall be removed with a sawing motion. Finish top curb with a steel trowel and finish edges with a steel edging tool.
- E. As soon as the concrete has set sufficiently to support its own weight, remove the front form and finish all exposed surfaces. Finish formed face by rubbing with a burlap sack or similar device that will produce a uniformly textured surface, free from marks, honeycomb

and other defects. All defective concrete shall be removed and replaced at the Contractor's sole expense. Upon completion of the finishing, apply an approved curing compound to exposed surfaces of the curb. Curing shall continue for a minimum of five days.

- F. Upon completion of the curing period, but not before seven days has elapsed since pouring the concrete, backfill the curb with earth, free from rocks two inches and larger and other foreign materials. Tramps backfill firmly in place.
- G. Finished curb shall present a uniform appearance for both grade and alignment. Remove any section of curb showing abrupt changes in alignment or grade, or which is more than 1/4 inch away from its location as staked, construct new curb in its place at the Contractor's sole expense.

3.5. SIDEWALK CONSTRUCTION

- A. Sidewalks shall be a minimum of four inches thick in walk areas and six inches thick in driveway areas. Refer to the Construction Drawings for additional detailing.
- B. At locations where the new sidewalk is to abut existing concrete, sawcut concrete for a depth of two inches and chip the old concrete back to sound material on a straight line, clean surface, and apply a neat cement paste just prior to pouring the new sidewalk.
- C. Place preformed asphalt expansion joints as in the adjacent curb, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk.
- D. Provide weekend plane joints transversely to the walks at locations opposite the contraction joints in the curb. Plastic pulltop quickjoint strips or approved equal at 1-1/2 inch deep.
- E. Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher shall govern.
- F. At a minimum, broom the surface with a fine hair broom at right angles to the length of the walk and tool at all edges, joints and markings or surface finish as required by the construction Drawings. Mark the walks transversely at five-foot intervals with a jointing tool. Upon completion of the finishing, apply an approved curing compound to the exposed surfaces. Protect the sidewalk from damage for a period of seven days.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 32 00 10 – FIELD ENGINEERING

PART 1 - GENERAL

1.0 SUMMARY

- A. Section Includes: Quality Control, Survey References Points, Submittals, and Project Record Documents.

1.1. DESCRIPTION

- A. Work included: provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:
 - 1. Establishing and maintaining lines and levels.
 - 2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.
- B. Related Documents:
 - 1. Bid Proposal
 - 2. Contract General Conditions
 - 3. Supplementary General Conditions
 - 4. Section 01 10 00 - Summary
 - 5. Section 01 33 00 - Submittal Procedures
 - 6. Section 01 44 00 - Quality Requirements
 - 7. Section 01 77 00 - Closeout Procedures

1.2. QUALITY ASSURANCE

- A. The Contractor is solely responsible for the complete, timely, and accurate layout of the work including, but not necessarily limited to, horizontal and vertical control and dimensional coordination as necessary to construct the work in accordance with the Contract Documents.
- B. Employ a Land Surveyor or a Civil Engineer, registered in the State of California to perform survey work.
- C. Employ a Professional Engineer of the discipline required for specific service on the project and licensed in the State of California where required in the technical specifications.

1.3. SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points are shown on the Contract Documents.
- B. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.
 - 1. Make no changes or relocations without prior written notice to Architect.
 - 2. Report to Architect when any reference point is lost or destroyed.
 - 3. Contractor is responsible to hire a surveyor to replace or re-establish project control points, which may be lost or destroyed at no additional cost to the District.
- C. Establish replacements based on original survey control.

1.4. PROJECT SURVEY REQUIREMENTS

- A. Establish and maintain lines and levels, locate and lay out:
 - 1. Site Improvements
 - a) Stakes for grading, fill, and topsoil replacement.
 - b) Utility slopes and invert elevations.
 - 2. Batter boards for structures.
 - 3. Building foundations, column locations, and floor levels.
 - 4. Controlling lines and level required for mechanical and electrical work.
- B. From time to time, verify layouts.

1.5. SUBMITTALS

- A. Comply with pertinent provisions of Division 1.
- B. Submit, name, address, and telephone number of Surveyor before starting survey work.
- C. If requested by Architect, submit documentation to verify accuracy of field engineering work.
- D. Submit certificate signed by the Engineer or Land Surveyor, licensed to practice in the State of California, certifying that elevations and locations of improvements are in conformance with the requirements of the Contract Documents, or if in non-conformance, and explanation of the discrepancy.

1.6. PROCEDURES

- A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities.
 - 1. Locate and protect control points before starting work on the site.
 - 2. Preserve permanent reference points during progress of the Work.
 - 3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
 - 4. Promptly advise the Architect when a reference point is lost or destroyed or requires relocation because of other changes in the Work.
 - a) Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
 - b) Locate such replacements according to the original survey control.

1.7. PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. Upon completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
- C. Submit Record Documents under provisions of Section 01700 – Project Closeout.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

SECTION 32 12 14 – SUBGRADE AND ROADBED

PART 1 – GENERAL

1.1. DESCRIPTION

- A. This section includes, but is not necessarily limited to the work necessary for the preparation of the subgrade.
 - 1. The subgrade will be considered as those areas and surfaces of new or existing streets, alleys, driveways, parking lots, sidewalks, or other places upon which additional materials are to be placed under Contract, or which are to be constructed or prepared for the future placement thereupon of other materials in accordance with Section 31 20 00 – Earth Moving, and as provided herein.

1.2. RELATED WORK DESCRIBED ELSEWHERE

- A. All underground work in the area of the subgrade shall be completed and properly backfilled before subgrade work is started. This is intended to include work on the Contract, work to be performed by the School District, or by others.
- B. These Specifications are to be used in conjunction with requirements in those sections of the Specifications having to do with specific types of base materials and pavements.
 - 1. Section 31 10 00 - Site Clearing
 - 2. Section 31 20 00 - Earth Moving
 - 3. Section 32 12 15 - Aggregate Base
 - 4. Section 32 12 16 - Asphalt Paving
 - 5. Section 32 13 13 - Concrete Paving

PART 2 – PRODUCTS

2.1. EXCAVATION AND ENBANKMENT

- A. The excavation shall include removal of materials which are encountered in excavating to the required grades, including existing pavements and curbs designated to be removed, or as required to accomplish the construction.

2.2. EQUIPMENT

- A. Furnish all necessary equipment required to accomplish the excavating, shaping, grading and rolling, and compaction specified herein.

PART 3 – EXECUTION

3.1. SUBGRADE

- A. Excavate and shape subgrade to line, grade, and cross section. Roll subgrade with an approved roller until the top 12 inches is compacted to 95 percent of maximum density at optimum moisture content as determined by ASTM D 1557. Remove all soft or otherwise unsuitable material disclosed by the rolling and replace with suitable material from the excavation. Fill holes, and depressions which develop under the roller, to the required grade and cross sections with material from the excavation. The finished subgrade shall be within a tolerance of plus or minus 0.10 of a foot of the grade and cross section shown. The subgrade shall be smooth and free from irregularities and at the specific density. Compaction shall extend one foot beyond the edge of paving, curb, or form work.
- B. The Contractor shall be responsible for the protection of existing improvements, any damage resulting from his operations shall be the Contractor's sole responsibility.

3.2. EXCAVATION BELOW GRADE

- A. Where a Geotechnical Engineer deems subgrade material to be unsatisfactory, excavation below grade will be required to such depths as necessary to remove the unsatisfactory material. Excavation below grade shall be of the same classification as that above it, provided it is removed in the same operation as the normal excavation. Where the Contractor has completed the excavation, and is required to remove additional, unsuitable material beyond the scope provided in these specifications, or where additional depth requires special equipment because of unforeseen conditions, the work shall be performed and a payment for excavation below grade will be made on the basis of extra work as provided in the Contract.
- B. If the excavation below grade is required because of negligence on the part of the Contractor, the necessary excavation below grade and the backfilling required to restore the surface satisfactorily shall be at the Contractor's sole expense.
- C. The subgrade shall be sprinkled with water as required, and in such quantities as necessary, to obtain the specified compaction.

3.3. PROTECTION OF SUBGRADE

- A. After preparing the subgrade as above specified, all unnecessary traffic shall be kept off. Should it be found necessary to haul over the prepared subgrade, the Contractor shall grade and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All ruts, cuts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.
- B. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross section. Will not be permitted. The contractor shall protect the prepared subgrade from both construction and public traffic.
- C. The subgrade shall be maintained in the finished conditions until the first succeeding source is placed.

3.4. DRIVEWAYS

- A. Excavate and shape driveways to the lines, grades, and cross sections shown, or as determined in the field by the Engineer.

END OF SECTION

SECTION 32 12 15 – AGGREGATE BASE

PART 1 –GENERAL

1.0 SUMMARY

- A. Section includes: This section covers the materials and work necessary for construction of aggregate base, as specified, complete.
- B. Related Sections:
 - 1. See Division 1 – General Requirements, which contain information and the requirements that apply to the work specified herein.
 - 2. Section 32 12 14 - Subgrade and Roadbed
 - 3. Section 32 12 16 - Asphalt Paving
 - 4. Section 32 13 13 - Concrete Paving
 - 5. The Geotechnical Investigation Report and the Geotechnical Engineer.

1.1 SUBMITTALS

- A. Samples and Testing: At least thirty (30) days prior to the use thereof, the Contractor shall submit to the Geotechnical Engineer a sample of aggregate, graded as intended for use. Provide sample size as directed by the Geotechnical Engineer, not to exceed 120 lbs. This requirement shall be complied with for each aggregate and grading thereof that has not been reviewed. The Geotechnical Engineer will test the sample at no cost to the Contractor, and will determine the acceptability of the aggregate.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate: The aggregate shall be free from vegetable matter and other deleterious substances. Aggregate for aggregate base shall consist of material of which at least 60 percent by weight shall be crushed particles as determined by Test Method No. Calif. 205.
 - 1. The percentage composition by weight of aggregate base shall conform to one of the following gradings when determined by Test Method No. Calif. 202.
 - 2. The particle size distribution shall be in accordance with the grading specified for 3/4-inch maximum size aggregate.

Percentage Passing		
	1-1/2"	3/4"
Sieve Size	Maximum	Maximum
2-Inch	100	
1-1/2-Inch	90-100	
1-Inch		100
3/4-Inch	50-85	90-100
No. 4	25-45	35-60
No. 30	10-25	10-30
No. 200	2-9	2-9

3. The aggregate base shall also conform to the following quality requirements:

	Test Method		
Tests	No. Calif		Requirements
Resistance (R-Value)*	301	78	Minimum
Sand Equivalent	217	22	Minimum
Durability Index	229	35	Minimum

4. The aggregate shall not be treated with lime, cement, or other chemicals before the Durability Index test is performed.
5. Material yielding a maximum dry density of less than 112 pounds per cubic foot when tested in the laboratory in accordance with ASTM "Standard Methods of Test of Moisture-Density Relations of Soils, Using 10-Pound Rammer and 18-Inch Drop", Designation D 1557, shall not be used.
6. Any rock, including red rock, meeting all the requirements of this Section will be acceptable. Such rock shall be plant processed at an approved processing plant.

2.2 EQUIPMENT

- A. Furnish all necessary equipment required to accomplish the spreading, shaping, and compaction required.

PART 3 – EXECUTION

3.1 SUBGRADE

- A. Proof roll subgrade immediately prior to commencement of spreading of aggregate base. Make necessary repairs as directed by the Geotechnical Engineer OR as described in Section 321214 - Subgrade and Roadbed

3.2 DELIVERY AND SPREADING

- A. Aggregate base material shall be delivered to the roadbed as uniform mixtures; each layer shall be spread in one operation.
- B. At the time aggregate base is spread it shall have a moisture content sufficient to obtain the required compaction. Such moisture shall be uniformly distributed throughout the material.
- C. The material shall be spread upon the prepared subgrade by means of vehicles equipped with approved spreading devices at a uniform quantity per linear foot, which quantity will provide the required compacted thickness within the tolerances specified.
- D. Depositing and spreading shall commence at that part of the work farthest from the supply of base material and shall progress continuously without breaks, unless otherwise directed by the Geotechnical Engineer.
- E. Where the required thickness is six inches or less, the base material may be spread and compacted in one layer. Where the required thickness is more than six inches, the base material shall be spread and compacted in two or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed six inches. Each layer shall be spread and compacted in a similar manner.

- F. Base materials placed in areas inaccessible to the spreading equipment may be spread in one or more layers by any means that will make possible the specified compaction and surface.
- G. When the subgrade for the aggregate base consists of cohesionless sand, and written permission is granted by the Geotechnical Engineer, the base materials may be dumped in piles upon the subgrade and spread ahead from the dumped material.
- H. The base materials, after spreading, shall be shaped by means of blade grader to such thickness that after watering and compacting, the completed base will conform to the required grade and cross section within the tolerances specified.
- I. Segregation of aggregate shall be avoided; the base shall be free from pockets of coarse or fine material.

3.3 COMPACTION

- A. Immediately following spreading, shaping, and smoothing, the full width of the base material shall be watered as ordered by the Geotechnical Engineer, and compacted by rolling with a minimum of two pieces of self-propelled reversible equipment. Compaction shall be as follows:
 - 1. For initial rolling use a 3-wheel steel-tired roller, weighing not less than 12 tons distributed so that the rear wheels will apply to the surface being rolled not less than 325 pounds per linear inch of rear tire width. Rolling shall commence by covering completely the outer edge of the material. Subsequent passes shall lap at least 25 percent on previously rolled material.
 - 2. For subsequent rolling use a pneumatic-tired roller of the oscillating type, having a width of not less than four feet and equipped with tires of equal size and diameter. Wobble wheel rollers will not be permitted. The tires shall be so spaced that the entire gap between adjacent tires will be covered by the tread of the following tire. The tires shall be inflated to 90 pounds per square inch minimum.
 - 3. To compact all areas inaccessible to the rollers, use compressed air or gas-powered tampers.
- B. The foregoing equipment requirements serve as a standard of adequacy.
- C. Subject to the condition that the Contractor shall notify the Geotechnical Engineer at least ten (10) days in advance and shall secure approval for the use of each piece of compacting equipment other than that specified, selection thereof, and obtainment of the specified compaction throughout the volume of base and the specified surface shall be solely the responsibility of the Contractor.
- D. If compaction is not uniform or tests show to be inadequate, or if the surface is unsatisfactory, the Geotechnical Engineer may require the use of other or additional equipment.
- E. Should low or high spots develop during rolling operations, such spots shall be smoothed by blading with a self-propelled, pneumatic-tired motor grader having a wheelbase not less than 15 feet long and a blade less than 10 feet long.
- F. Aggregate base shall be watered after compaction. Water shall be applied at the rate and in the quantities ordered by the Geotechnical Engineer.
- G. The relative compaction of aggregate base, determined by tests of the in-place, field compacted base shall not be less than 95 percent if the maximum compaction at optimum moisture content determined by the ASTM Methods of Test, Designation D 1556 and

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

Method C of Designation D 1557. The tests will be conducted and evaluated in the laboratory by the Geotechnical Engineer at no cost to the Contractor.

- H. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below proper grade; such surface shall contain no ridges, valleys or sharp breaks.
- I. Finished base that does not conform to the foregoing requirements shall be reshaped or reworked, watered, and thoroughly recompact to conform thereto.
- J. The Contractor shall not allow any completed untreated rock base to be subject to public or construction traffic, except the latter necessary to the completion of the overlying surface courses.

END OF SECTION

SECTION 32 12 16 – ASPHALT CONCRETE PAVING

PART 1 – GENERAL

1.0 SUMMARY

- A. Section Includes: This section covers the work necessary for construction of the asphalt concrete leveling course and surface course used for paving roadways and parking areas, and the repair and replacement of existing pavement that has been disturbed by trenching or other construction.
- B. Related Sections:
 - 1. See Division 1 – General Requirements, which contain information and requirements that apply to the work specified herein.

1.1 SUBMITTALS

- A. Submittals during construction shall be made in accordance with Division 1, General Requirements.
- B. Product date: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that materials meet or exceed the specified requirements.

1.2 QUALITY ASSURANCE

- A. Standards: The following shall form a part of this specification and shall have the same force as if reproduced in total herein:
 - 1. Standard Specifications.
 - 2. Materials Manual of Testing and Control Procedures, State of California, Business and Transportation Agency, Department of Transportation, herein after referred to as "Materials Manual".
 - 3. ASTM D 1557 shall be used for the method of performing compaction tests.

PART 2 – PRODUCTS

2.1 ASPHALT

- A. Asphalt concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant:
 - 1. Asphalt concrete shall be as required by jurisdiction.
 - 2. Grade of asphalt shall be AR-4000 or AR-8000 as required.
 - 3. Density shall be 95% of maximum laboratory density as determined by California Test Method 304.
 - 4. Stability shall be 30 minimum.
 - 5. Mineral aggregate shall be Type B, 1/2-inch maximum size aggregate, medium grading, and shall conform to the following requirements:

- a) The particle size distribution shall be in accordance with the grading specified for 1/2-inch maximum size aggregate.

<u>Sieve Size</u>	<u>Maximum Percentage Passing</u>
3/4-Inch	100
1/2-Inch	95-100
3/8-Inch	80-85
No. 4	54-64
No. 8	38-48
No. 30	20-30
No. 200	3-8

6. Drying, proportioning, and mixing of the materials shall conform to Section 39 of the Standard Specifications.

- B. Slurry Seal Coat shall be Type II slurry seal and shall be a one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of manufacturer to the Engineer.
- C. Seal Coat shall be equal to SS1H one coat process, or approved equivalent. The manufacturer shall supply the product in sealed containers, or provide certification of the manufacturer to the Engineer.

2.2 AGGREGATE

- A. Aggregate base shall conform to the provisions of Section 32 12 15 – Aggregate Base and as provided herein.
1. The grading of the aggregate shall be "1/2-inch Maximum, Medium" as described hereon, except in conform or overlay areas, the grading shall be 3/8-inch maximum.
- B. Sampling and testing will not be required. The Contractor shall provide test results as indicated in this section.

2.3 COMPOSITION OF MIXTURE

- A. At least thirty (30) days prior to producing any of the mixture for use in the paving, the Contractor shall submit to the Engineer for approval a job – mix formula which meets the requirements herein specified. No asphalt pavement work shall be undertaken by the Contractor until the Engineer has reviewed the job – mix formula.
- B. The Contractor shall be responsible for locating an acceptable source of aggregate. All tests confirming the suitability of the material for the purpose intended shall be obtained by the Contractor at the Contractor's expense. Certified copies of the aggregate test results from an independent testing laboratory shall be furnished to the Engineer for review at least one week prior to delivery of aggregate to site or use of aggregate in asphalt concrete.
- C. The Contractor shall make arrangement and pay for preparation of the asphalt concrete job mix formula. The job-mix formula for the asphalt concrete mixture shall establish the percentage of aggregate passing each sieve size, and the percentage of bituminous material to be added to said aggregate, and the temperature at which test results from a qualified, independent testing laboratory confirming the job-mix formula shall be submitted by the Contractor to the Engineer for review at least two weeks prior to the start of asphalt concrete paving. Any proposed deviations from the original job - mix formula shall be resubmitted

by the Contractor for review. Test results of aggregate used in asphalt shall be provided as indicated in this section.

- D. The job - mix formula shall indicate the gradation of each of the several aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.
- E. After a job - mix formula is established and reviewed, all mixtures furnished under this Contract shall conform to the requirements and tolerances as stated in these Specifications.

2.4 WEED CONTROL

- A. Spray applied herbicide, currently approved for designated use by all applicable agencies, including air pollution control jurisdiction.

PART 3 – EXECUTION

3.1 PREPARATION OF ROADWAY

- A. Subgrade shall be fine graded per Section 31 20 00 – Earthwork and Section 32 12 14 – Subgrade and Roadbed. The finished subgrade shall be tested and approved by the Geotechnical Engineer prior to the placement of aggregate base.
- B. Thoroughly blend base course aggregate on the job site. Construction shall conform to applicable portions of Section 26 of Standard Specifications. Base material shall be placed, watered as required, and mechanically compacted until a relative compaction of 95% has been obtained for the entire thickness of the base. Each layer of the base course shall be tested and approved by the testing laboratory prior to the placement of successive layer. Compacted base thickness shall be as indicated on the drawings.
- C. Apply herbicide chemical to all areas to receive paving in strict accordance with the printed instructions of the manufacturer. Take all necessary safety precautions to protect against damage or injury due to its poisonous nature. No weed-control chemical is to be applied to areas designed for planting.
- D. A tack coat of asphalt applied at the rate of 0.05 to 0.12 gallons per square yard shall be applied uniformly to all surfaces on which any course of asphalt concrete is to be placed.
- E. The tack coat shall be emulsified asphalt. The emulsified asphalt may be mixed with water at the rate of 1 to 2 parts water to 1 part of emulsified asphalt.
- F. Preparation of Untreated Roadway:
 - 1. A prime coat shall be applied over the full length of the project and asphalt concrete pavement shall not be placed until the prime coat has been cured.
 - 2. Should any holes, breaks, or irregularities develop in the roadway surface after the prime coat has been applied, they shall be patched with asphalt concrete immediately in advance of placing the asphalt concrete. The Contractor shall maintain the completed prime coat by blading or brooming with motor patrol graders, until the asphalt concrete is placed.
 - 3. After the maintenance, patching or repair work has been completed and immediately prior to placing the asphalt concrete pavement, the surface of the prime coat shall be swept clean of all dirt, dust or other foreign matter.

3.2 ASPHALT CONCRETE PAVEMENT

- A. The proportioning and mixing of asphalt concrete shall conform to the provision provided herein. The pounds of asphalt per 100 pounds of dry aggregates shall not vary by more than 5% above or 10% below the amount indicated in the job-mix formula. This requirement shall apply to samples taken from a single batch, successive batches, at different locations in the production plant, or at any location on the construction site.
- B. Paint binder shall be applied in conformance with the provisions provided herein.
- C. Spreading equipment and methods shall conform to the provision provided herein. No asphalt concrete shall be placed on any section of compacted aggregate base that has not been reviewed by the Geotechnical Engineer.
- D. The asphalt concrete shall be compacted in accordance with the provisions provided herein. The weight and pressure of the Contractor's pneumatic-tired roller will be reviewed, but not designated or approved, by the Geotechnical Engineer.
- E. Confirm areas associated with placement of asphalt concrete conform to the provisions provided herein.

3.3 PLACEMENT OF ASPHALT CONCRETE PAVING

- A. Install the specified curbs, headers and stakes, to achieve the arrangement of paving shown on the drawings. All unconfined edges shall be confined with 2 inch by 4 inch redwood header boards staked with a 1 inch by 3 inch redwood stake 18 inches long minimum at 6 feet on-center. Two 1 inch by 4 inch pieces may be installed together for bending along curves. Offset all joints by 2 feet.
- B. Remove all loose materials from the compacted base.
- C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations as approved by the Engineer.
- D. Asphalt paving shall be installed in minimum lifts of 2 inches.
- E. Adjust frames, covers and utility vaults, if so required, to meet final grades.
- F. Do not accept receipt or asphalt concrete materials unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees Fahrenheit.

3.4 CONNECTIONS WITH EXISTING FACILITIES

- A. Where it is necessary to remove existing asphalt surfaces or oil mat surfaces to provide proper meet lines and riding surfaces, the Contractor shall burn or chip the existing surface so that there will be sufficient depth to provide a minimum of one inch of asphalt concrete, and the waste material shall be disposed of to the satisfaction of the Engineer and Federal, State and Local Ordinances. Prior to placing the asphalt concrete these areas shall be tacked. Meet lines shall be straight and the edges vertical. The edges of meet lines cut shall be painted with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, the meet lines shall be sealed by painting with a liquid asphalt or emulsified asphalt and immediately covered with clean, dry sand.
- B. Prior to laying down the second strip of asphalt concrete pavement, the edge of the first strip laid and other contact surfaces such as curbs, manhole frames, and similar materials shall be painted with emulsified asphalt or liquid asphalt to provide closely bonded watertight joints. This work shall be done in a manner that will prevent staining adjacent surfaces not intended to be coated.

3.5 COMPACTION

- A. Rolling shall continue until all roller marks are eliminated and a minimum density of 140 pcf has been obtained.
- B. Field density tests shall be made by a commercial testing laboratory retained by the Owner, and the test results submitted to the Geotechnical Engineer for review.

3.6 JOINTS

- A. The placing of the top or wearing course shall be as nearly continuous as possible, and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is discontinued for such length of time as to permit the mixture to become chilled.
- B. When the work is resumed the previously compacted mixture shall be cut back to produce a slightly beveled edge of the full thickness of the course. The material which is cut away shall be wasted and the new mix shall be laid against the fresh cut. Rollers or tamping irons shall be used to seal the joints.

3.7 SURFACE TOLERANCE

- A. Tests for Conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be immediately corrected by the removal or addition of materials and by continuous rolling.
- B. The completed surface of the top of wearing course shall be of uniform texture, smooth, uniform as to crown and grade and free from defects of all kinds. The completed surface shall not vary more than 1/8 inch from the lower edge of a 10-foot straight edge placed on the surface parallel to the centerline.
- C. After completion of the final rolling, the smoothness and grade of the surface shall again be tested by the Contractor.
- D. When deviations in excess of the above tolerances are found, the pavement surface shall be corrected by the addition of asphalt concrete mixture of an appropriate class to low places or the removal of material from high places by methods satisfactory to the Engineer, or by removal and replacement of the wearing course asphalt concrete. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.
- E. All areas in which the surface of the completed pavement deviates more than twice the allowable tolerances described above shall be removed and replaced to the satisfaction of the Engineer.
- F. All costs involved in making the corrections of defects described above shall be borne by the Contractor and no compensation will be made for this work.

3.8 APPLICATION OF SEAL OR SLURRY COAT

- A. Areas that have received new AC shall have a minimum of 30 day cure time prior to application of either seal or slurry coat. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Geotechnical Engineer.
- B. Apply one coat of the specified sealer.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges and other surface irregularities.

3.9 SAMPLES

- A. The contractor shall, without additional charge, provide the Geotechnical Engineer with test results of samples of asphalt concrete cut from the completed pavement or the individual courses thereof. The minimum number of tests cores shall be two per day during paving. The number of cores shall be increased if problems are indicated. The contractor shall also provide the Geotechnical Engineer with test results or samples of the uncompressed asphalt concrete mixtures, and all materials incorporated in the work.

3.10 UNFAVORABLE WEATHER

- A. Asphalt for prime coat shall not be applied when the ground temperature is lower than 50 degrees F without written permission of the Geotechnical Engineer.
- B. Asphalt concrete shall not be placed when the atmospheric temperature is less than 40 degrees F nor during heavy rainfall.

3.11 ALLOWABLE TOLERANCES

- A. Surface Smoothness:
 - 1. The surface of the finished base course shall not vary more than 3/8 inch, plus or minus, in 10 feet.
 - 2. The surface of the finished asphalt concrete shall not vary more than 1/4 inch, plus or minus, in 10 feet.
- B. The compacted paving or base course thickness shall not vary more than 1/4 inch plus or minus, based on an average of five (5) measurements per 10,000 square feet, taken at randomly selected locations by testing laboratory.
- C. Provide hot plant mixed asphalt concrete paving materials.
 - 1. Temperature leaving the plants shall be 290 degrees Fahrenheit minimum, 320 degrees Fahrenheit maximum.
 - 2. Temperature at time of placing shall be 280 degrees minimum.

3.12 SURFACE FINISH

- A. Surface finish shall be uniform and consistent in color and texture throughout the extents of the project and shall be achieved, at a minimum, by applying a slurry coat.

END OF SECTION

SECTION 32 13 13 – SITE CONCRETE PAVING

Part 1. General

1.01 Related Documents

- A. The Drawings and general provisions of the Contract, including General and Special Conditions and Division 1, General Requirements, Apply to the work specified in this section.
- B. Parts 1,2,3,4,5,6, Title 24 of the California Code of Regulations (California Building Code) is to be considered an integral part of this section.
- C. All California Prevailing Wage Laws apply to the work of this section.

1.02 Work Included

- A. The following is a general description of the work included in this section. This description does not limit the scope of work shown in the drawings nor does it relieve the Contractor of any responsibility for coordination of all work of this Contract.

Item	Description

General	

- Furnish and install all concrete as shown and specified. This work includes, but is not necessarily limited to concrete pavement, waterproofing, forms, reinforcing, and miscellaneous items.
- Concrete paving, headers, curbs, and site work.
- Concrete walk repair where existing walks are disturbed or damaged as part of the work of this project.
- Incidental concrete repair for utility trenching and other sub-grade construction.
- All other concrete flatwork required in conjunction with the work of this project.
- Refer to Architectural drawings for masonry wall, gate footings and related concrete work.

- B. Related work may be described in other sections of this Project Manual. All sections of this project manual are related. Contractor shall coordinate the work of this section with all other sections.

1.03 Submittals

- A. Provide the following submittals per the requirements of Division 1.

Item	Description
Catalog Cuts	n/a
Samples/Mockups	Provide manufacturer's color charts. In addition, provide 2'x 2' sample on site of each concrete paving type and color as shown on plans, for color and finish.
Mix Design	- The proposed mix design, giving the brand of cement, type, gradations and source of aggregates, water/cement ratio, mix proportions, and unit weight. - Manufacturer's literature for admixtures, embedded items, liquid membrane-form curing compound and non-shrink grout. - Certification that materials are in compliance with specification requirements. - Method of transporting and placing concrete.
Shop Drawings	n/a
Product Data	Provide product data for each type of product and process specified in this section and incorporated into the work of other sections during fabrication, finishing, and installation.
Schedule	Provide written delivery and installation schedule for purposes of coordination, notification and completion.

1.04 References / Standards

- A. The following References and Standards are incorporated into the requirements of this Section as they apply to products, assembly, manufacturing procedures and installation. References shall be utilized in determining "Industry Standards" and other acceptable manufacture and installation methods but shall not relieve the Contractor of any other responsibilities of the Contract. Where conflicts occur between multiple listed references, the Contractor shall assume that the more restrictive standard applies and shall seek determination from the District Representative regarding applicable standard.

- Unless otherwise shown or specified, all materials and methods shall conform to the appropriate current sections of:
 1. District Standards for Public Improvements.
 2. The State of California, Department of Transportation Standard Specifications (DTSS) sections 52 and 90 except for measurement and payment requirements.
 3. Applicable ASTM Specifications as they reasonably apply to this work, except for measurement and payment requirements.
 4. American Concrete Institute (ACI), current standards.

1.05 Quality Assurance

Item	Description
Qualifications of Workers	• Provide paving subcontractor experienced in Institutional grade flatwork, accessibility requirements and pedestrian hazard management.
Product Acceptance	• Provide assurance that concrete finish will match existing where specified
Substrate Acceptance	Commencement of work implies acceptance of substrate, including: • Compaction • Base composition

1.06 Quality Control

- A. The following specific procedures shall be required to demonstrate adequate levels of quality provided for project components and systems. Exclusion of any item from this list does not relieve the Contractor of any responsibilities for quality procedures covered elsewhere in the Contract Documents.

Item	Description
Tolerances	• Tolerances for sub-grade, sub-base and finished grade shall be as specified by DTSS except that Contractor shall deliver the full aggregate base and concrete thickness shown. No combination of high and low tolerances that compromise the section will be permitted.
Finish and Color	• The Contractor shall demonstrate to the

satisfaction of the District and the Landscape Architect that he, or his subcontractor, possesses sufficient skills and experience to perform the work. Photographs and/or site visits of past work may be required to supply this information. A 2' x 2' sample of all concrete pavement types shall be poured and finished at the site for District Representative's review prior to commencing concrete pouring. Samples shall contain same thickness, material composition, finish, color and texture as specified for the project. Once the samples have been reviewed, the Contractor shall meet or exceed that quality of finish in all subsequent work. Contractor shall be responsible for removal of the samples at the completion of the work.

Weather Limitations	• Construct concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.
Grade Control	• Establish and maintain the required lines and grades, including cross-slope during construction operations. All concrete shall slope to drain with no ponding of water. • District Representative to observe initial placement and finishing to determine compliance with expected finish quality and consistency. • District Representative to observe selected placement throughout project and accept or reject based on expected finish quality and consistency

1.07 Warranty

A. Provide written warranty in accordance with Division 1.

Item	Description
Warranty Form	• Contractor to provide warranty against defects in materials or workmanship. Replacement or repair of such defects shall be repaired or replaced in a timely fashion at no additional cost to the District.

Warranty Period	• 1 year
Warranty Start	• Substantial Completion

1.08 Close Out

- A. Provide written warranty in accordance with Division 1.

Item	Description
Commissioning Requirements	• Refer to Division 1 for detailed Commissioning Procedures. General Commissioning Requirements. • Spot check for gradient and drainage by District Representative. • Specific review of finish consistency. • Specific review of trip hazards.

Part 2. Products

2.01 Materials

- A. Forms: Shall be dimensional lumber, straight, and free and clear of any defects.
- B. Reinforcing:
1. All reinforcement material: new and free from scale, rust, or coatings, which will reduce bond to concrete.
 2. Unless otherwise noted, use only deformed reinforcement.
 3. Reinforcing steel: Deformed billet steel bars, ASTM A615, Grade 60, except stirrups and ties #3 or smaller may be Grade 40. ASTM A706 for reinforcement to be welded.
 4. Tie wire: 16 gauge or heavier, black annealed steel wire.
- C. Dowels at Expansion Joints: Greenstreak Speed Dowel sleeve, with smooth steel dowel.
- D. Concrete: Class 1 conforming to Section 90 of the DTSS.
1. Cement: Type II modified conforming to ASTM-C-150.
 2. Aggregate: Minimum 3/8 inch, maximum 3/4 inch size.
 3. Compression strength at 28 days shall be 3,000 p.s.i. minimum.
 4. Provide minimum 5-1/2 sacks of cement per cu. yd., with a maximum slump of 4 inches.
- E. Color Admixture: shall be "lamp black" at the rate of 1/2 lb. per cubic yard.

- F. Expansion Joint Filler: "Fibre" joint filler manufactured by W.R. Meadows Seal Tight, 1/2" thick. Conforming to ASTM D 1757.
- G. Expansion Joint Sealer: Sikaflex – 2c (two-component, self-leveling, polyurethane elastomeric sealant, with color added). Color to be selected by Architect.
- H. Cleaning Agents: As required.
- I. Aggregate Base: refer section 32 12 15.
- J. Finish: Light Broom.

Part 3. Execution

3.01 Preparation

- A. Clear area to be paved of all debris and organic material. Recompact and regrade as necessary prior to placement of concrete. Verify that the subgrade and/or aggregate base is properly compacted and at suitable grade.
- B. Before beginning paving work and during construction, take all steps necessary for protection of existing improvements. As the concrete is being placed, extreme care shall be taken not to discolor or damage any adjacent improvements. If satisfactory repair cannot be made, remove and replace the section as directed.
- C. Formwork and Reinforcement:
 - 1. Assure that excavations and formwork are completed.
 - 2. Check that reinforcement is secured in place.
 - 3. Verify all slopes are in conformance with plans. Notify Architect if any discrepancies or slopes that exceed those as specified in drawings.
 - 4. Verify that expansion joint material, anchors, and other embedded items are secured in position. Plastic caps shall be in place over expansion joint filler.
- D. Expansion Joints:
 - 1. General:
 - a. Expansion joints shall be laid out with form boards, and dowels installed with speed dowel sleeves securely attached to form board, so they are perpendicular to joint.
 - b. Rebar and dowels shall be placed appropriately at expansion joints. Rebar shall not run continuous across expansion joints.
 - c. Place top of expansion joint $\frac{3}{4}$ " below finished surface. After concrete has cured, remove plastic caps. Caulk joint per detail.
 - d. Cardboard shall never be used for sleeves. Speed dowel sleeves, or approved equal, shall be used to ensure proper dowel alignment with forms.
 - 2. New Expansion Joints at Existing Site Paving: Existing concrete with rough or damaged edges shall be repaired before new site concrete is placed. Color and finish shall match existing concrete.
 - 3. New Expansion Joints within New Concrete Area:

Dowels shall be aligned perpendicular to joint. They shall be attached firmly to form with speed dowels or approved equal. Dowels placed in loose form openings or allowed to float freely during the pour will result in rejection of the entire work.

3.02 Placement

- A. Finishes
 - 1. Provide a medium broom finish for all concrete flatwork specified. Finish shall be applied uniformly and in straight, parallel lines. Sample finish shall be reviewed and accepted prior to pouring the concrete. *All walkway surfaces shall have a non-slip finish as required by code.*
- B. Convey all concrete to place of final deposit by methods that will prevent separation and loss of material. Place concrete as dry as practical, consistent with specified slump, and with a maximum temperature of 80 degrees F and minimum temperature of 50 degrees F at the time of placement. Do not use retempered concrete.
- C. Thoroughly consolidate and compact the concrete by suitable means during placement, completely embedding reinforcing steel, anchors, and filling of corners.
- D. Tamp slabs with a jitterbug and depress coarse aggregates, using pushfloat to level and finish to screeds without depressions. Trowel slabs to a smooth, dense surface, and finish as noted.
- E. Wet slabs shall meet all screeds and existing work accurately and shall not rise above or be below them. Carefully contour at all new or existing imbedded items so as to avoid depressions or obstructions. No bird baths!
- F. Make all slabs even and uniform in appearance, sloped uniformly to provide even fall or drainage. All surfaces shall have a slip-resistant finish.
- G. Cure concrete for a minimum of five (5) days before removal of forms. Use spray applied biodegradable monomolecular curing compound for slabs such as Master Builders "Confilm."
- H. Water-spray all concrete for minimum of three (3) days, and keep moist at all times during daylight hours.

3.03 Clean Up

- A. Upon completion of the work under this section, remove immediately all surplus materials, rubbish, and equipment associated with or used in the performance of this work.
- B. Remove all plastic caps from expansion joints.
- C. Install sealant at all the expansion joints.

3.04 Defective Work

- A. Immediately after forms are removed, inspect concrete surfaces. If voids, rock pockets, or other imperfections exist, patch before concrete becomes thoroughly dry.
- B. Patching of minor defective areas shall include the wetting of the area to be patched and the surrounding area, the pre-coating of the area to be patched with the epoxy bonding agent specified, and the patching of the area with non-shrink grout, as specified, and in accordance with the respective manufacturer's printed recommendations.
- C. Architect reserves the right to reject and require replacement of defective concrete work for reasons including, but not limited to, the following:
 - 1. Deficient grades and "bird baths"
 - 2. Deficient edge and joint tooling
 - 3. Inconsistent finish texture or color
 - 4. Inconsistent joint width and depth

End of Section

SECTION 32 17 00 – Pavement Specialties

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Parking lot striping.
- B. Disabled loading zone striping and disabled parking symbol.
- C. Traffic symbols.
- D. Curb painting.
- E. Traffic and parking control signage.
- F. Sport Court striping.
- G. Truncated Domes

1.2 RELATED SECTIONS

- A. Section 32 12 16 - Asphalt Pavement.
- B. Section 32 13 13 - Concrete Paving.
- C. Section 10 14 00 - Signage.

1.3 QUALITY ASSURANCE

- A. Materials and work of this section shall conform with Local Municipality Public Works standards and specifications.
- B. Submittals:
 - a. Product data: Contractor shall submit product data cut sheets for all products used in this section.
 - b. Samples: All products with color options, such as truncated domes, shall be submitted for review/selection.

1.4 REGULATORY REQUIREMENTS

- A. Conform to regulations of Bay Area Air Quality Management District and California Air Resources Board regarding use of paint.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do no painting when surface and air temperatures are below 40 degrees F or below those temperatures recommended by the paint manufacturer.

PART 2 - PRODUCTS

2.1 STANDARD CATALOG PRODUCTS

- A. Symbol Marking Paint and Traffic Marking Paint: Water borne product conforming to State Specification 8010-426-30; Dunn-Edwards Traffic Paint W801, Sinclair 160 Vinyl Traffic Paint, or equal product.
 - 1. ISA Symbol Background: Color - Blue. Size: As indicated in the drawings.
 - 2. Parking Stall Striping, Traffic Symbols and Disabled Loading Zone Striping and Lettering: Color - White. Width for all striping: Three inches, or as indicated in the

drawings. Blue border around access aisle.

3. Disabled Stall Curbs: Color - Blue. Width for all striping: Three inches, or as indicated in the drawings.
 4. Sport Court Striping: Color - White.
- B. Truncated Domes: Precast concrete tiles, integral color, 12" x 12" size, wet-set in concrete paving per manufacturer's instructions. Available from Tectura Designs, 800-388-8728.
Color: To be selected by Architect from standard color samples.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine receiving surfaces and verify that surfaces are proper for installation.
- B. Do not start work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, oil, grease, and other foreign matter from the areas of the pavement and curbs to be painted.
- B. Do not apply traffic paint to surfaces which are excessively dirty, damp, and cold.

3.3 INSTALLATION

- A. Apply parking lot as a 4 inch wide solid line. Apply loading zone striping as 8 inch wide solid line.
- B. Stripe parking stalls to the dimensions as shown on the Drawings; traffic symbols shall be as shown. Stripe loading zone to dimensions shown on Drawings.
- C. Paint the ISA parking symbol in each accessible parking stall as indicated on the Drawings and in accordance with the American National Standard Institute Figure A117.1.
- D. Paint horizontal and vertical face of curbs abutting accessible parking stalls. See Drawings for extent of painted curbs.
- E. Apply traffic paint with atomizing spray type striping machine equipped with separate thermostatically controlled heating devices for each paint pot and capable of applying paint whereby the lines and markings have clear-cut edges, true and smooth alignments and uniform thicknesses.
- F. Apply paint with completed lines and marking clean, sharp and to dimensions.
 1. Ragged ends of segments, foggy appearance along the sides or objectionable dribbling of paint along the unpainted portions of the strips will not be permitted.
 2. The finished paint shall have an opaque, well painted appearance with no black

or other discolorations showing through.

- G. Set posts for parking sign plumb in minimum 12 inch diameter concrete footings with top of footing 6 inches below finished grade and bottom of footing minimum 36 inches below finished grade. Slope top of concrete for water runoff. Cap top of pipe.
- H. Secure signs to posts with saddles and vandal-proof nuts.
- I. Install parking control signs with bottom of upper sign 60 inches above finished grade. Install accessible parking signs with bottom of upper sign 80 inches above finished grade. Install lower signs in two sign assemblies with top within 1 inch of bottom of upper sign.

3.4 PROTECTION

- A. Exercise reasonable precautions to protect the paint, as applied, during drying time. Remove objectionable tracking.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 32 31 20 - ORNAMENTAL STEEL FENCING (CUSTOM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Ornamental perforated steel fencing panels welded into metal frame, including steel fence posts and gates.
- B. Related sections:
 - 1. Section 03 30 00 – Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM A36 - Structural Steel.
 - 2. ASTM A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.
 - 3. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 5. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 6. ASTM D822 - Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
 - 7. ASTM D1794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 8. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.3 SUBMITTALS

- A. Provide in accordance with Section 01 33 00 - Submittal Procedures:
 - 1. Product data for components and accessories.
 - 2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.
 - 3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.

4. Copy of warranty specified in Paragraph 1.4 for review by Architect.
5. Prepare on-site fencing mockup which shows typical footing. Mockup to be approved by Architect prior to fence installation.

1.4 WARRANTY

- A. Provide in accordance with Section 01700 – Contract (Project) Closeout:
 1. Ten (10) year warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Local distributor/fabricator recommended for sourcing material is Grating Pacific, Inc. 1398 Mariani Court, Tracy, CA 95376 (209-832-6363) contact Dave Scheuerlein.
- B. Manufacturers of equivalent products submitted and approved in accordance with Section 01 62 00 – Product Options and Substitutions.

2.2 MATERIALS

- A. Steel sheet: ASTM A653.
- B. Steel tubing: ASTM A500, Grade B.
- C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.3 FENCE SYSTEM

- A. Type: Ornamental steel fencing system consisting of posts, top and bottom rails, and pickets.
- B. Fence panels: Fabricated from square steel tube top and bottom rails with steel pickets.
 1. Top and bottom perimeter rails: 14 gauge 1-1/2 inch square steel tubes.
 3. Panel height: As shown on drawings.
 4. Panel width: As shown on drawings.
- C. Posts: square steel tubes, 14 gauge
 1. Size: Per drawings.

2. Length: As shown on drawings.
3. Weld flat steel bar top caps to tubular posts.

2.4 GATES

- A. Provide gates of type and size indicated on Drawings. Equip gates with hardware as indicated in gate hardware schedule and manufacturer's standard hardware as required for complete functional operation.
- B. Type: Hinged swinging single and double gates.
 1. Construction: Welded frame fabricated from steel tubing and solid bar with perforated steel panels to match fencing material.
 2. Nominal size: As shown on drawings.
 3. Hardware:
 - a. Hinges: Size and type per drawings.
 - b. Hardware: As indicated in gate hardware schedule.

2.5 ACCESSORIES

- A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition. Use attachment system and fasteners to secure panels to supporting members as shown on plans.
- B. For exposed locations, provide anti-intruder bolts consisting of cup head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.6 FACTORY FINISH

- A. Steel fence panels and posts shall be hot-dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123. Standard size components shall receive polyester powder coating. Large gate panels shall be coated with 2-part polyurethane coating.
- B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
 4. Minimum hardness measured in accordance with ASTM D3363: 2H.
 5. Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.
 6. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 5 mm undercutting.

- C. Polyurethane coating: 1.0 mil dry film thickness of coating of steel test panel cured 30 minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:
 - 1. 5 percent salt spray for 500 hours.
 - 2. 100 percent relative humidity for 1000 hours.
 - 3. Water immersion for 100 hours.
 - 4. 20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.
 - 5. Exposure to lubricating oils, hydraulic fluids, and cutting oils.
 - 6. 16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.
 - 7. Hardness: H to 2H.
 - 8. Flexibility: 1/8 inch conical mandrel.
- D. Color: Selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to fabrication, field verify required dimensions.
- B. Cast concrete footings in accordance with Section 32 13 13 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

3.2 INSTALLATION

- A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.
- B. Install fence posts plumb and level [by embedding post directly in concrete footing.] Temporarily brace fence posts with 2 by 4 wood supports until [concrete] is set.
- C. Do not installed bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
- D. Gates:
 - 1. Install gates and adjust hardware for smooth operation.
 - 2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.

3. After installation, test gate. Open and close a minimum of five times. Correct deficiencies and adjust.
- E. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 32 31 20

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 32 92 00

TURF PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Sodding.

1.3 DEFINITION:

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending nutrients, minerals, soils or sand with stabilized organic soil amendments to produce surface planting soil capable of sustaining plant growth.
- D. Planting Soil: On-site topsoil, import topsoil or manufactured topsoil.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.

- F. On-site Topsoil: Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil and plant lab.
- G. Substantial completion for landscape and irrigation: Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.
- H. Final completion for landscape and irrigation: Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

1.4 SUBMITTALS

- A. Product and Material Data: For each type of product specified. Submit manufacturer's technical data and installation instructions for landscape products conforming to requirements of Section 01 33 00 Submittal Procedures to include, but not be limited to:
 - 1. Analysis of proposed soil amending materials by Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, made according to methods established by the Association of Official Analytical Chemists, where applicable.
 - 2. Samples for Verification: For each of the following:
 - a. Soil conditioner (1/2 c.f. each).
 - 3. Certification of turfgrass sod, identifying source, including name and telephone number of supplier.

4. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
 5. Planting soil amendments as recommended by Waypoint Analytical California, Inc. (408) 727-0330, or approved equal.
- B. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner's Representative upon delivery.
- C. Qualification Data: For landscape Installer prior to performing work.
- D. Planting Schedule: Indicating anticipated planting dates for turf installation.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Experience: The turf installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
 2. Licensure: The turf installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
 3. Supervision: The turf installation firm shall have a qualified and experienced turf technician on site during turf installation.
- B. Soil-Testing Laboratory Qualifications: Testing lab shall be Waypoint Analytical California, Inc., located in San Jose (408) 727-0330 or Anaheim (714) 282-8777, or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- C. Soil Analysis: Furnish soil analysis by a qualified soil-testing laboratory, Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity (CEC) or total exchangeable cations (TEC); sodium absorption ratio; deleterious material; pH; soluble salts, boron, mineral and plant-nutrient content of planting soil.
 - 1. Report suitability of planting soil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Protect all lawn areas from damage or trespass by maintaining construction fencing during construction and maintenance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Sod: Harvest, deliver, store, and handle sod according to requirements in Turf Producers International's (TPI) "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

- A. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Sodded Lawns: Maintenance period shall be a minimum of ninety (90) days from date of Owner's Representative written approval of Substantial Completion and when there are no visible joints, roots are thoroughly knit to the soil and sod appears to be uniformly healthy and green in color.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and spraying for insects and disease and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Implement pest management as necessary to controls pests, including gophers.
 - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and/or maintain temporary piping, hoses, and lawn-watering equipment as necessary to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of mulch.
 - 2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one third ($\frac{1}{3}$) of grass height. Remove no more than one third ($\frac{1}{3}$) of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow and edge before turf reaches three and one-quarter ($3\frac{1}{4}$) inches high.
 - 2. Cut to two and one-half ($2\frac{1}{2}$) inches high.

3. Remove all clippings.

E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

F. Maintain protective barriers in place, erect and secure and clear of lawn edges to allow for uniform growth and for trimming and so as not to block irrigation spray pattern.

1.9 WARRANTY

A. All work executed under this Section shall be warranted free of defects and poor workmanship for a period of one (1) year after date of Final Completion.

B. Turf planting shall be warranted to be in healthy and thriving condition during Warranty period, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.

C. Repair and/or re-sod turf areas not in vigorous condition immediately upon notification by Owner's Representative during Warranty period.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Not less than 2 years old, free of weeds

and undesirable native grasses and machine cut rolls to pad thickness of 5/8 inch, rolled, 4' wide and 90' length.

- B. Turfgrass Species: Sod of grass species as follows, with not less than 90 percent germination, not less than 95 percent pure seed, and free of weed seed:
 - 1. Blue-Rye or equal. www.deltabluegrass.com, (800) 637-8873.
 - a. Mixture of 50% bluegrass blend and 50% premium ryegrass blend.
- C. Delivery, Storage and Handling: Sod shall be harvested, delivered and installed within a period of 24 hours. Sod shall be kept moist, fresh and protected at all times.

2.2 PLANTING SOIL

- A. Prior to placing bid, Contractor to coordinate with General Contractor, Demolition and/or Grading Contractors and verify quantity and source of planting soil for turf planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of six (6) inches of planting soil in turf planting areas and rough grading in accordance with these specifications, details, notes, grading and drainage plans.
- B. Coordinate with General Contractor, Demolition and/or Grading Contractors for removal and replacement of any lime treated soils and replacement with planting soil prior to planting turf to depth required to remove lime treatment.
- C. On-site topsoil: Reuse existing topsoil or existing surface soil, found in the top twelve (12) inches, excavated and stockpiled on-site. Verify suitability of existing and/or stockpiled surface soil to produce planting soil by submitting a sample to Waypoint Analytical California, Inc. (408) 727-0330, or approved equal. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 6.0 to 7.0, representative of productive soils in the vicinity, a range of 4 to 20 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR)

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm.

- D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:

1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.

Class	Particle Size Range	Maximum %	Minimum %
Coarse Sand	0.5 – 2mm	15	0
Silt	.002 - .05 mm	30	10
Clay	< .002 mm	25	10

Other Classes			
Gravel	2 – 13 mm	15	0
Rock	½ - 1 inch	5% by volume with none > 1 inch	
Organic		15	0

2. Chemistry – Suitability Considerations

Salinity: Saturation Extract Conductivity (ECe)	Less than 3.0 dS/m @ 25 degrees C.
Sodium: Sodium Adsorption Ratio (SAR)	Less than 1.00 ppm
Boron: Saturation Extract Concentration	Less than 6.00 ppm

Reaction:	5.5 – 7.5 <u>without</u> high lime content.
pH of Saturated Paste:	

3. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.
4. Soil testing: Contractor shall submit to the Owner's representative for approval, certification from an agricultural soils testing laboratory, Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, that the import topsoil provided conforms to the specifications prior to delivery of import or placement of on-site topsoil. Soil testing shall have been performed on import topsoil source within the previous year.

2.3 FERTILIZER AND SOIL AMENDMENTS

- A. Contractor shall collect and submit two samples of proposed planting soil, representative of the top six (6) inches of planting soil, to a locally known soil testing laboratory, Waypoint Analytical California, Inc. (408) 727-0330, or approved equal, for analysis and amendment recommendations. Soil samples shall be taken from proposed planting areas or topsoil source. Sample shall be taken to a depth of 8 inches. Contractor shall amend per soil testing laboratory recommendations. Soil amendments in this specification are provided for bidding purposes only.
- B. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.
- C. Soil Preparation: As specified in soil laboratory recommendation. The following materials and quantities are given for bidding purposes only. Contractor shall amend soil using products, quantities and methods specified by Waypoint Analytical California, Inc., or approved equal.
 - 1. 6-20-20 granular fertilizer.
 - 2. Soil sulfur.
- D. Soil Conditioner: 0-1/4 inch nitrogen-fortified organic amendment contributing at least 270 pounds of organic matter per cubic yard.

2.4 HERBICIDES

- A. All herbicides shall be approved by the District prior to use.
- B. Contractor shall contact Owner's Representative prior to application of herbicides for District policies, rules and regulations pertaining to herbicide application.
- C. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove broad-leaf weeds from existing turf.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

- D. Non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove herbacious vegetation in areas indicated.

2.5 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to sodded areas.

2.6 LANDSCAPE EDGINGS/HEADERBOARD

- A. Wood Strip Edging: Of sizes shown, and as follows:
 - 1. Wood Material: Construction heart redwood, 2 by 6 in size, length as required.
 - 2. Stakes: Construction grade, rough sawn, wood, 2 by 2 by 16 inches long in nominal size, with galvanized, wood, screws for anchoring edging to wood strip edging.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

3.2 PREPARATION

- A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- C. Install protective barriers and/or fencing as necessary.
- D. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides,

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.

E. Import Planting Soil Installation:

1. Remove and dispose of stones larger than one (1) inch in any dimension, vegetation and foreign inorganic material from surface to receive import topsoil.
2. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported topsoil layer to subgrade.
3. Place topsoil on loosened material in six (6) inch layers. Crossrip first import topsoil layer to a depth of eight (8) inches and blend import topsoil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate topsoil and compact to 85% density.
4. Continue placement of import topsoil after blending first layer with native soil in six (6) inch layers and rolling lightly to consolidate and compact each layer of topsoil.
5. Place topsoil to the lines and grades in accordance with grading Drawings.

F. Verify installation of planting soil to minimum depth of six (6) inches and rough grading completed to proper slopes and elevations.

3.3 SOIL AMENDING AND FINE GRADING (Amend per Soil-Testing Laboratory recommendations. The following recommendations are given for bidding purposes only.)

- A. Soil Preparation: Loosen subgrade of planting beds by crossripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.
- B. Soil Amending: (Amend per Soil-Testing Laboratory recommendations. The following recommendations are provided for bidding purposes only.) Add the following and thoroughly till into the top six (6) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.

1. 6 cubic yards nitrogen fortified organic soil amendment.
 - a. In order to comply with MWEL 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than six percent (6%) organic matter in the top six (6) inches are exempt from adding compost.
2. 14 pounds all-purpose granular fertilizer (6-20-20).
3. 15 pounds soil sulfur.

C. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges.

1. There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.
2. In sodded turf areas, one (1) inch below adjacent paved surfaces, utility boxes, tops of curbs, etc.

D. Moisten prepared lawn areas before planting if planting soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil conditions.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted planting soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
 - 3. Hold sod clear of all tree trunks and tree staking, create a circular edge 12" clear of all tree trunks.
- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist planting soil to a minimum depth of 1-1/2 inches below sod.

3.5 SELECTIVE BROADLEAF WEED KILL

- A. Refer to herbicide manufacturer recommendations. Apply selective broadleaf herbicide where indicated prior to disturbing on-site soil per manufacturer recommendations. Re-apply as necessary for complete weed kill by end of maintenance period.

3.6 MAINTENANCE SCHEDULE

- A. Protection: Protect work from damage, erosion and trespass. Maintain construction fencing in proper condition. Remove temporary fencing and/or barriers prior to final completion and at end of maintenance period.
- B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis, each week during plant establishment and monthly thereafter. Adjust and repair the irrigation system and its components as necessary for turf establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.
- C. Fertilizing (confirm with Soil and Plant Laboratory, or approved equal, recommendations): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.
- D. Weed Control: Maintain turf planting areas in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. Contractor shall obtain written approval from project owner prior to application of herbicide. No herbicide shall be used without the Owner Representative's prior consent. Use only approved herbicides, use in accordance with manufacturer's recommendations and per Pest Control Advisor's recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions. Review and perform weekly during maintenance period.
- E. Lawns: Maintain lawns by watering, fertilizing weeding, trimming, mowing and other operations such as rolling, re-grading and replanting as required to establish a

smooth, acceptable lawn, free of weeds, bare spots and rocks. All lawn areas shall be mowed regularly when grass reaches a height of three and one-quarter (3-1/4) inches and a minimum of two (2) days prior to end of maintenance period.

- F. Disease, Pest and Insect Control: Disease, pest (including moles, gophers and geese) and insect damage shall be controlled by the use of fungicides, insecticides, pesticides, poisons and/or mechanical means. Contractor shall obtain written approval from project Owner prior to application of fungicides, insecticides, poisons, pesticides and/or mechanical means and shall abide by all posting requirements prior to application. Review and perform weekly during maintenance period.

3.7 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION

- A. Contact Owner's Representative a minimum of 48 hours prior notice for review and approval of the following prior to proceeding with subsequent work:
 - 1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.
 - 2. Layout: Layout of all plants, headerboard and other major elements shall be directed and/or approved by the Owner's Representative.
 - 3. Substantial Completion Review (Pre-maintenance): At substantial completion of this Section, work shall be reviewed for conformance with the Drawings. Written approval shall mark beginning of the maintenance period.
 - 4. Final Completion Review: At the end of specified maintenance period, work shall be reviewed for conformance with Drawings including additional requirements stipulated during maintenance period shall be extended at Contractors sole cost as directed by the Owner's Representative.
 - 5. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.
- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory and upon written approval of Owner.

3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period

END OF SECTION 32 92 00

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 33 00 10 – TRENCHING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section includes, but is not necessarily limited to, trench, backfill, and compaction as specified herein and as needed for installation of underground utilities associated with the Work.
- B. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02 30 00 – Subsurface Investigation
 - 3. Section 02 41 19 – Selective Demolition
 - 4. Section 31 10 00 – Site Clearing
 - 5. Section 31 20 00 – Earth Moving
 - 6. The Geotechnical Investigation Report and the Geotechnical Engineer.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the recommendations of the Geotechnical Engineer.

1.3 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 00 – Product Requirements

PART 2 – PRODUCTS

2.1 SOIL MATERIALS

- A. Fill and backfill materials:
 - 1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 2 inches in the greatest dimension.
 - 2. Fill materials is subject to the approval of the Geotechnical Engineer, and is that material removed from excavations or imported from off-site borrow areas, predominantly granular, non-expansive soils, free from roots and other deleterious matter.
 - 3. Do not permit rock having a dimension greater than 1 inch in the upper 12 inches of fill.
 - 4. Cohesionless Material Used for Structural Backfill: Provide sand free from organic material and other foreign matter, and as approved by the Geotechnical Engineer.

5. Bedding material shall meet the minimum standards listed below:

Sand Equivalent	20
Sieve Size	Percentage Passing Sieve
1 inch (2.54 cm)	100
No. 4	80-100
No. 200	0-15

2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES.

- A. Comply with pertinent provision of Section 32 00 10 – Field Engineering

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines as shown on the Drawings or otherwise made known to the Contractor prior to trenching. If damages, repair or replace at no additional cost to the Owner.
2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.

B. Protection of Persons and Property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavement, and other facilities from damaged caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

- C. Dewatering
 - 1. Remove all water, including rainwater, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
 - 2. Keep excavations and site construction area free from water.
 - D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and other work being performed on or near the site.
 - E. Maintain access to adjacent areas at all times.
- 3.4 TRENCHING
- A. Comply with pertinent provision of Section 31 20 00 – Earth Moving, and the provisions of this Section.
 - B. Provide sheeting and shoring necessary for protection of the Work and for the Safety of personnel.
 - 1. Prior to backfilling, remove all sheeting.
 - 2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Architect, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Architect may permit portions of sheeting to be cut off and remain in the trench.
 - C. Open Cut:
 - 1. Excavate for utilities by open cut.
 - 2. If conditions at the site prevent such open cut, and if approved by the Engineer, trenching may be used.
 - 3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
 - 4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the Geotechnical Engineer.
 - 5. When the void is below the subgrade for the utility bedding, use suitable earth materials and compact to the relative compaction directed by the soil engineer, but in no case to a relative compaction less than 90%.
 - 6. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted, or consolidated as proved by the Geotechnical Engineer, but in no case a relative compaction less than 90%.
 - 7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
 - 8. Excavating for appurtenances:
 - a) Excavate for manholes and similar structures to a distance sufficient to leave at least 12 inches clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b) Over depth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Geotechnical Engineer, and at no additional cost to the owner.

- D. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.
- E. Depressions:
 - 1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
 - 2. Except where rock is encountered, do not excavate below the depth indicated or specified.
 - 3. Where rock is encountered, excavate rock to a minimum overdepth of 4 inches below the trench depth indicated or specified
- F. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, over, and other requirements as set forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.
- G. Cover:
 - 1. Provide minimum trench depth indicated on plans to maintain a minimum cover over the top of the installed item below the finish grade or subgrade.
 - 2. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long-radius rigid metal conduit riser, provided it will not interfere with the structural integrity of the slab or pavement.

3.5 BEDDING

- A. Bedding for trenches in that material supporting, surrounding, and extending to 1 foot above the top of the pipe. Where concrete is specified to cover the pipe, the top of the concrete shall be considered as the top of the bedding.
- B. Where it becomes necessary to remove boulders or other interfering objects at subgrade for bedding, any void below such subgrade shall be filled with the bedding material.
- C. Bedding material, approved by the Geotechnical Engineer and meeting the minimum standards listed in Section 2.1.A.5 shall be deposited and compacted to 90% relative compaction in the trench uniformly on both sides of the pipe for the full width of the trench and to a depth of 12 inches over the top of the pip. For pipes larger than 48 inches diameter, bedding material shall be placed up to spring-line.

3.6 BACKFILLING

- A. General
 - 1. Do not completely backfill trenches until required pressure and leakage tests have been performed and until the utilities systems as installed conform to the requirements specified in the pertinent Sections of these Specifications.
 - 2. Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with selected material approved by the Geotechnical Engineer.
 - 3. Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified or otherwise correct to the approval of the Geotechnical Engineer.
 - 4. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.

5. Should any of the Work be enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.
 - B. Lower Portion of Trench:
 1. Deposit approved backfill and bedding material in layers of 6 inches maximum thickness, and compact with suitable tampers to the minimum density directed by the Geotechnical Engineer.
 2. Take special care in backfilling and bedding operations to not damage pipe and pipe coatings.
 - C. Remainder of Trench:
 1. Deposit backfill materials in layers not exceeding 6 inches in thickness, and compact each layer to the minimum density directed by the soil engineer. It shall be compacted to a relative compaction of 90% for the remainder of the trench, except that the top 12 inches shall be brought to 95% compaction. The backfill under and around any and all pipes shall be thoroughly consolidated before any additional material is placed.
 - D. Adjacent to buildings: Mechanically compact backfill within ten feet of buildings.
 - E. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the Geotechnical Engineer, in areas other than building and pavement areas.
- 3.7 TEST FOR DISPLACEMENT OF SEWERS AND STORMDRAINS
- A. Check sewers and stormdrains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.
 - B. Visual Inspection: Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror to inspect the inside of the pipe.
 - C. Deflecting Test: If visual inspection demonstrates potential deflection failure, and odd-leg mandrel (go-no-go) shall be pulled through the installed pipe. Deflection shall not exceed manufacturer's recommendation. Testing shall be performed within 30 days of installation.
 - D. If the illuminated interior of the pipeline to the deflection test shows poor alignment, displaced pipes, or any other defects, correct the defects to the specified conditions and at no additional cost to the Owner.
- 3.8 PIPE JACKING
- A. The Contractor may, at his option, install steel pipe casings, tongue-and-groove reinforced concrete pipes, and steel pipes under existing roads or pavements by jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the Geotechnical Engineer.
- 3.9 TUNNELING OPERATIONS
- A. The Contractor may, at his option, tunnel pipes into position using procedures approved by the Geotechnical Engineer and the governmental agencies having jurisdiction.
- 3.10 FIELD QUALITY CONTROL
- A. The Geotechnical Engineer will inspect and approve open cuts and trenches before installation of utilities, and will make the following tests:
 1. Assure that trenches are not backfilled until all tests have been completed.
 2. Check backfilling for proper layer thickness and compaction.
 3. Verify that test results conform to the specified requirements, and that sufficient tests are performed.

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

4. Assure that defective work is removed and properly replaced.

END OF SECTION

SECTION 33 10 00 – WATER UTILITIES

PART 1 – GENERAL

Section 33 10 00 includes general specification for potable water pipelines and appurtenances. Potable water pipeline installation must conform to these specifications and the American Water Works Association (AWWA) requirements.

Work must comply with Nipomo Community Service District Standard Specifications.

1.1 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 33 00 – Administrative Requirements.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, or within the timeframe specified in the Division 1 section, whichever is shorter, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 - MATERIALS

Water system main pipeline may be Ductile Iron or PVC. Water system services may be Copper, Polyethelene or Schedule 80 PVC.

2.1 DUCTILE IRON PIPE:

Ductile Iron Pipe Ductile iron pipe must:

- 1. Be centrifugally cast
- 2. Be ductile iron pipe
- 3. Have end joint which employs a single elongated rubber gasket such as Tyton Joint or an approved equal.
- 4. Have a pressure class 150 minimum for potable water systems
- 5. Have coated outside
- 6. Be lined inside with seal-coated cement lining of 1/16 inch minimum thickness, all conforming to applicable ASA and AWWA Specifications.

2.2 POLYVINYL CHLORIDE (PVC) PIPE:

Polyvinyl Chloride (PVC) pipe must:

- 1. Comply with AWWA C900 Standards
- 2. Be pressure class 235, DR-18
- 3. Be blue in color.

2.3 POLYETHYLENE TUBING

Polyethylene tubing must:

1. Be pressure rated for 200 psi
2. SDR-9 conforming to ASTM D-2737 and AWWA C901 standards
3. Copper tube size for diameters greater than 1 inch
4. Iron pipe size for diameters 1" and smaller
5. Be manufactured for use with standard compression fittings
6. Clearly marked showing:
 - a. Manufacturer's trade name
 - b. Nominal size
 - c. Type of material
 - d. Pressure rating
 - e. Seal of approval of an accredited testing laboratory.

2.4 SOLID SLEEVES

Solid sleeves must be ductile iron with flanged or mechanical joints ends. Minimum sleeve length is 1 foot.

2.5 HIGH DENSITY POLYETHYLENE (HDPE)

Use:

1. Virgin grade
2. High molecular weight
3. Standard Dimension Ration (SDR) 11
4. Iron Pipe Size (IPS)

High Density Polyethylene (HDPE) pipe made in diameter and tolerances in compliance with the latest version of ASTM D3035.

Furnish complete with all fabricated fittings, and other appurtenances as necessary, for a complete and functional system.

The pipe must be free of:

1. Visible cracks
2. Holes
3. Foreign inclusions, or
4. Other defects.

Any pipe not meeting these criteria will be rejected.

The pipe must be clearly marked with the following:

1. Name and trademark of manufacturer
2. Nominal pipe size
3. Dimension ratio
4. The letters PE followed by the polyethylene grade per the latest version ASTM D1248
5. Hydrostatic design basis in psi
6. Manufacturing standard reference
7. A production code from which the date and place of manufacture can be determined.

The material must be listed by the Plastic Pipe Institute (PPI) with a designation of PE 3408 and have a minimum cell classification of:

1. 345434C
2. D, or
3. E

As described in latest version of ASTM D3350.

Pipe material must meet the requirements for:

1. Type III
2. Class B or C
3. Category 5
4. Grade P34

Material as described in latest version of ASTM D1248.

Provide submittals on furnished pipe from manufacturer certifying pipe is in compliance with:

1. Specifications
2. Codes 87
3. Standards

Any pipe segment that has cut in the pipe wall exceeding 10 percent of the wall thickness must be cut out and removed from the site.

Store pipe so that it is not deformed.

2.6 JOINTS AND FITTINGS

All fittings must be cement lined by the centrifugal process in compliance with USA Standard A21.4, as amended to date. Cement lining must be standard thickness. Joint and fitting types must be:

1. Mechanical
2. Compressed gasket,
3. Flanged, or
4. Flexible coupling type.

Mechanical joint type fitting, gasket, gland and bolts must class 250 ductile iron and conform to:

1. USA Standard A21.10
2. USA Standards A21.11 (AWWA C111)
3. USA Standard A21.12 (AWWA C112)
4. WW-P-421c 5. WW-P-360b

Compressed gasket joint type must use a single elongated rubber gasket to seal joint such as Tyton Joint, or an approved equal.

Flange joint bolts must be stainless steel type 304 installed using anit-sieze lubricant.

Flexible coupling type must be:

1. Ford,
2. Romac,
3. Smith Blair, or
4. Approved equal.

The couplings must be straight or transition as shown.

2.7 NOT USED

2.8 CHECK VALVES

Gate valves must be:

1. Mueller, or
2. Approved equal meeting the following requirements.
 - a. Iron body
 - b. Bronze mounted
 - c. Swing check valves with outside spring and lever.
 - d. Bronze valve seat ring must be back-faced and screwed into an accurately machined body

- e. Cast iron gate mounted with a bronze gate ring.
- f. Gate rings machined to provide a water-tight surface.
- g. Gate must be hung solid bronze hinges and stainless steel hinge pins
- h. Minimum working pressure of 150 psi. 77-2.02D(4)

PART 3- CONSTRUCTION

3.1 PIPE LAYING

Any deflection must be taken up in the length of pipe and not the joint. In all cases deflection must not exceed the manufacturer's recommendation.

Standard laying lengths for pipe is 20 feet + 0.3 feet for all pipe diameters. Random lengths of pipe may not be used.

3.2 ASBESTOS CEMENT PIPE

Asbestos Cement Pipe must not be used for new installations. When working with asbestos cement pipe, provide documentation that employees have received required training per OSHA.

Methods of work must comply with OSHA and other legal guidelines to prevent the release of fibers. Asbestos cement pipe may be cut only by an approved method and in compliance with OSHA guidelines. Sawing, grinding, drilling or any other activity that could result in the release of asbestos fibers is prohibited.

Asbestos Cement Pipe, if not either:

- 1. Broken
- 2. Crushed
- 3. Friable

It is not a hazardous waste. Verify with landfill prior to disposal.

3.3 POLY VINYL CHLORIDE (PVC)

Pipe Installation Install PVC water pipe in compliance with AWWA C605 Standards.

3.4 JOINTS AND FITTINGS

Install joints and fitting in compliance with manufacture's recommendations and this Section. Provision must be made for expansion and contraction at each joint with an elastomeric ring.

3.5 MECHANICAL JOINTS

Clean length of ends of pipe of all

- 1. Oil
- 2. Grit
- 3. Other foreign material

By brushing with a wire brush and then painted with a soap solution made by dissolving 1/2 cup of granular soap in one gallon of water.

Install mechanical joint by:

1. Place the gland on the pipe with lip extension of the gland toward the socket or bell end of the joint.
2. Paint the rubber with the NSF approved pipe joining lubricant and place on the pipe with the thick edge toward the gland.
3. Push the pipe into the bell to seat the spigot and gasket into place.
4. Gasket must be evenly located around the entire joint.
5. Place the gland against the gasket.
6. Insert the bolts and place the nuts and tighten with torque wrench.
7. Tighten nuts one hundred eighty degrees (180°) apart alternately, to produce an equal pressure on all parts of the gasket.
8. Torque 90 foot-pounds.

3.6 COMPRESSED GASKET JOINTS

Install compressed gasket joint by:

1. Wipe gasket and gasket socket clean with a cloth or brush.
2. Insert gasket into socket with thickened edge entering first.
3. Gasket groove must fit over bead in socket.
4. Apply a thin film of lubricant on portion of gasket that will come in contact with the entering pipe.
5. Wipe clean and place in proper alignment the plain beveled end of pipe with the bell of the pipe to be joined.
6. Apply a film of lubricant to the outside of the plain end for a 2-inch length. No foreign materials on lubricant will be allowed.
7. Fit the plain end of the pipe into the socket so that it is in contact with the gasket.
8. Join the pipes by exerting sufficient force on the plain end pipe and is moved past the gasket making contact with the socket.

3.7 FLANGED JOINTS

Tighten nuts one hundred eighty degrees (180°) apart alternately to produce an equal pressure on all parts of the flange and gasket.

3.8 VALVES AND VALVE WELLS

Construct valve wells in compliance with Engineering Standards. Install valves in compliance with manufacturer's recommendation. Visually inspect the interior edge of the pipe that it is fitted to by turning the valve to ensure the rubber seal of the valve does not come into contact with the pipe. The interior edge of the pipe may need to be beveled to avoid contact and tearing of the rubber seal.

Complete paving work and construct valve well to final finished street grade.

Valve wells located outside of paved area must be raised 6 inches above finished grade. Construct concrete collar sloped away from valve well.

3.9 WATER SERVICES

Construct water service pipeline to convey water from the water main to the water meter using new water tubing.

Install water services in compliance with Nipomo Community Services Engineering Standards. The Engineer must approve all tools and equipment used for installation.

3.10 TAPPING SLEEVES

Furnish and install tapping sleeves with all necessary gaskets in compliance with Nipomo Community Services Engineering Standards.

3.11 EXISTING WATER PIPES

All new water pipe must be tested in compliance with Part 3, Section M, of Water Utilities Specifications and approved by the Engineer, prior to connection to the existing water system.

At a minimum, 24 hours in advance of connection to existing water pipe, pothole and verify existing pipe:

1. Depth
2. Diameter
3. Fitting needs.

Swab the interior of all pipes with a one (1) to five (5) percent hypochlorite disinfecting solution. Connect new water pipe to existing water pipe as shown. The connection detail as shown represents the approved connection detail and location. If you wish to make an alternate connection to the existing water system, provide a detailed drawing to the Engineer for review and approval.

3.12 ABANDONMENT OF WATERLINES

Abandon existing water system facilities taken out of service in compliance with Engineering Standards.

To abandon existing water services:

1. Excavate to existing water pipe at water service tube location.
2. Turn off corporation stop.
3. Disconnect existing water service tube from corporation stop.
4. Cap existing corporation stop.
5. Remove, cap or plug existing water service tube.
6. Remove existing water meter box.
7. Remove, cap or plug existing water service tube.
8. Inspect saddle and replace if needed.

3.13 TESTING

All new:

1. Water pipe
2. Water tubes
3. Valves
4. Joints and fittings
5. Fire lines
6. Services

7. Other water facilities

Must be tested prior to service.

Testing procedure for new water facility installations are:

1. Install water sampling station and temporary blow-offs – Sampling Section
2. Flush and load new water facility – see Flushing Section
3. Two hour pressure test – see Pressure Section
4. Disinfect new water facility – see Disinfection Section
5. Allow pipeline to disinfect for 24 hours – see Disinfection Section
6. Flush and load new water facility – see Flushing Section
7. 24 hour bacteria and chlorine test. Test chlorine levels for maximum level of chlorine residuals of one (2) part per million and bacteria contamination (non-spore forming) – see Disinfection Section
8. Remove sampling station and temporary facilities

Provide the Engineer proposed testing and flushing methods as well as schedule for review and approval prior to starting testing work. Repeat testing procedure as directed by the Engineer if any portions of the new water facility fail testing.

3.14 SAMPLING

Provide sample station. Sampling station may be a threadless hose bib or other flow controlling valve connected to the new water facility at either:

1. Fire hydrant
2. Blow-off
3. Backflow, or
4. Corporation stop

Located at the most remote point of the facility to be tested. Hose bib or other flow controlling valve must be a minimum of 1 foot above grade.

Notify the Engineer, at a minimum, two working days in advance of each sample need. Samples are taken between 8:00 A.M. and 1:00 P.M. Monday through Friday, excluding City holidays.

3.15 FLUSHING

Flush new water facilities at a rate of 2.5 cubic feet per second flush flow.

Install temporary blow-off per Engineering Standards as needed to load or flush new water facilities. Submit temporary blow-off locations to the Engineer for review and approval prior to installation.

Remove water and debris from new water facility by flushing and placing into truck or tank. Continue to flush new water facility until residual chlorine is removed.

Do not allow any water or chlorine solution into the street and storm drains.

3.16 DISINFECTION

Disinfect all new water facilities must comply with AWWA C651 Standard.

Place calcium hypochlorite granules or tablets in the main during construction; completely filling the main to eliminate air pockets with chlorinated water, free chlorine concentration of not less than 50 mg/L.

After 24 hours, flush water in compliance with Flushing Section.

Load pipeline with water. Wait at least twenty-four (24) hours and test water for:

1. Chlorine level which must be less than one (2) part per million
2. Bacteria contamination (non-spore forming)

Repeat flushing and disinfection until all requirements of this section are achieved.

3.17 PRESSURE

Pressure testing of new water facilities must comply with AWWA C605 Standards. All new water facilities must be pressure tested, after water facilities:

1. Have been placed and isolated from the existing water system
2. Trenches have been backfilled
3. Concrete thrust blocks have cured for a minimum of 36 hours

You may pressure test a new water facility against an existing valve that is closed at your own risk. Existing valves may leak. If the valve leaks, resulting in a failed test, you are responsible to modify the new pipe work by adding temporary blow-offs or other method, approved by the Engineer, to allow the testing to occur at no additional cost to the Client.

If hydrants or blow-offs are not available for expelling air, provide taps at highest points of elevation prior to testing. Insert plugs into pipe taps after tests are complete.

Pressure test new water facilities as follows:

1. Pressurize new water facility to 1.5 times the working pressure of adjacent pipeline facilities
2. Maintain pressure for two hours within 5 psi of test pressure.
3. Evaluate leakage.

Remove and replace any defective:

1. Pipes
2. Fittings
3. Valves
4. Hydrants, or
5. Consumer water services

Discovered during pressure test and repeat test.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 33 30 00 – SANITARY SEWER UTILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Provide sanitary systems as needed for a complete and proper installation.
- B. Related sections:
 - 1. Division 1 General Requirements
 - 2. Contract General Conditions
 - 3. Supplementary General Conditions
 - 4. Section 33 00 10 – Trenching, Backfilling, and Compacting
 - 5. Nipomo Community Services District Specifications and Drawings

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 30 00 – Submittals.
- B. Product data - Prior to starting work submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

PART 2 – MATERIALS

2.1 GENERAL

Provide documents or certified test results indicating the pipe furnished meets all specified requirements. Satisfactory documents include pipe manufacturer certificate indicating that the pipe has been:

- 1. Sampled
- 2. Tested
- 3. Inspected In compliance with the ASTM specifications.

2.2 POLYVINYL CHLORIDE (PVC)

Pipe Furnish pipe in 20 foot lengths with integral wall belled ends and elastomeric joint and solid wall. Pipe and fittings must be free of imperfections and clearly marked with name of manufacturer.

Minimum pipe stiffness (F/y) at 5 percent deflection is 46 psi for all sizes when calculated in compliance with ASTM Designation D 2412.

Pipe must have minimum Standard Dimension Ratio (SDR) of 35 and pipe stiffness of 46 psi. Pipe color must be green.

2.3 PVC PIPE 4 TO 15 INCH DIAMETER PVC

Pipe must conform to the requirement of latest version of ASTM specification D 3034.

2.4 SEWER LATERAL PIPE

New and repaired sewer lateral pipe may be:

1. PVC SDR 35

2.5 JOINTS AND FITTINGS

PVC

PVC pipe must have a rubber ring bell and spigot joints providing a water tight seal and allowing for contraction and expansion. The bell must consist of an integral wall Section stiffened with two PVC retainer rings that securely lock the solid cross Section rubber ring into position.

All fittings and accessories must be as manufactured and furnished by the pipe supplier, or approved equal, and have bell and/or spigot configurations identical to that of the pipe. All fittings must be of the same material as the pipe, unless specified otherwise.

Ductile Iron

Use restrained fittings for exposed ductile iron pipe, such as bridge crossings. Restrained fittings must be Flex-Ring by American Ductile Iron, TR FLEX by U.S. Pipe, or approved equal which use a factory weld as part of the restraining system.

Repair Joint

Use strong back RC couplings or equal meeting the following requirements:

1. Flexible sewer couplings and transition couplings
2. Comprised of an elastomeric sealing component
3. Type 316 series stainless steel tension components (end clamps and shear rings).
4. Shear rings must have a minimum thickness of 0.012 inches
5. End clamps must have "bolts" as their means of tightening (not worm gears).

Couplings must be appropriately sized for the pipe materials being joined, without the need for bushings.

Sewer Lateral Joints (New And Replacement)

Sewer lateral pipe must be joined using glued joints and fittings or fused.

2.6 CONCRETE

Use class 2 concrete.

Use minor concrete for:

1. Manholes
2. Pipe junctions
3. Jacketing.

Use fifteen percent approved pozzolan replacement for manhole construction.

Precast concrete manhole Sections must comply with the most current version of ASTM specification C-478-61T or AASHTO-M170.

All manholes must be watertight and the floor sloped for a smooth monolithic trowel finish. The interior finish of the manholes must be smooth.

2.7 MORTAR

Use one part of Type II Portland cement and two parts of:

1. Clean
2. Hard
3. Sharp grained particles
4. All passing a # 4 sieve

To make mortar.

Mix mortar in a machine or water tight box. Accurately measure and thoroughly mix mortar to a uniform consistency. Use mortar immediacy after mixing. Do not remix mortar that begins to harden prior to placement.

PART 3 - CONSTRUCTION

3.1 PIPE INSTALLATION

Sanitary sewer lines must be water tight. Install pipe to ensure the system is water tight throughout the component parts, particularly at the pipe joint.

Do not:

1. Cut
2. Gouge
3. Score or
4. Damage pipes

When

1. Unloading
2. Handling
3. Storing
4. Installing

3.2 PIPE LAYING

Lay the pipe in perfect conformity to the design line and grade obtained for each pipe by measuring down from a tightly stretched line running parallel with the grade.

Lay all pipes continuously uphill.

Install PVC pipe and fittings for underground gravity sewers in compliance with the latest version of ASTM Standard D-2321. Lay bell and spigot pipe, with the bell of the pipe upgrade.

3.3 SAND TRAPS

Furnish and install sand traps or other debris catching measure approved by the Engineer during the work. Debris catching devices must be installed at all times during construction. You assume all costs associated with any damage resulting from construction materials entering the wastewater system or treatment facility.

3.4 SEWER LATERALS

Sewer laterals must be tied over as shown. Notify the Engineer immediately upon discovering any lateral not shown, or any lateral that appears to be dry and out of service. The Engineer will then determine if it is live or not, and cap it off if dead.

3.5 REPAIR

Repair cut sewer facilities using new pipe of material in compliance with Sewer Materials Section and the same diameter. If the existing sewer pipe material complies with materials listed in Sewer Materials section, use that same pipe material. Pipe fittings must comply with those listed in Material section. Center a continuous Section of new pipe at the repair location. Repair must be water tight and placed at the same grade. Prior to backfilling excavation, place level on repaired portion of sewer, in the presence of the Engineer, to confirm line and grade. Backfill, compact and restore surface improvements in compliance with Section 33 00 10.

Repair must be documented with:

1. Location
2. Repairs made
3. Photos
4. Guarantee letter
5. Interior video inspection of pipeline, when directed by the Engineer Provide hardcopy of all documents to owner. Provide electronically, all documents to the Engineer.

3.6 TESTING

Air Test After the pipeline is in place and the joints made, you must air test the sewer in the presence of the Engineer. Air test procedure is as follows:

1. A maximum of 400 feet of sewer pipe will be tested at one time.
2. Plug and brace securely all outlets.
3. Introduce air into test Section until internal pressure is 4.0 psi. If sewer pipe is placed in ground water, calculate ground water pressure and add that additional pressure to internal pressure used for test.

4. Maintain an internal test pressure by adding air as need for a minimum time of 2 minutes.
5. Measure the time required for pressure to drop from 3.5 psi to 2.5 psi. Do not introduce new air into test Section during measurement.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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SECTION 33 40 00 – STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Work included: Provide storm sewerage system as show on the Drawings, specified herein, and as needed for a complete and proper installation.
- B. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
 - 2. Section 33 00 10 – Trenching, Backfilling, and Compacting.
 - 3. State of California Department of Transportation Standard Specifications, latest edition.
 - 4. MC-7200 Stormtech Chamber Specifications

1.2 REFERENCES

- A. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.
- B. ANSI/ASTM D2729:Poly Vinyl Chloride (PVC) sewer and pipe fittings
- C. ASTM D1248: Specification for Polyethylene Plastics Molding and Extrusion Material
- D. ANSI/ASTM D3033:Type PSP Poly Vinyl Chloride (PVC) storm sewer pipe and fittings
- E. Type PSM Poly Vinyl Chloride (PVC) storm sewer pipe and fittings
- F. ASTM D3350 – Specification for Polyethylene Plastics Pipe and Fittings Material.
- G. ASTM D2321 – Standard Practice for underground installation.
- H. ASTM D3350 – Specification for Polyethylene Plastics Pipe and Fittings Material; 2014.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 33 00 – Administrative Requirements.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, or within the timeframe specified in the Division 1 section, whichever is shorter, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.5 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 00 – Product Requirements.

PART 2 – PRODUCTS

2.1 PIPE MATERIALS

- A. Provide pipe and associated materials of the size indicated on the Drawings and meeting the following requirements.
1. Polyvinyl chloride pipe (PVC) ANSI/ASTM D3034:
 - a) Acceptable products:
 - (1) "Ring-Tite" plastic pipe fittings, class 160, SDR 35, manufactured by J-M Manufacturing Co., Inc., 9 Peach tree Hill Drive, Livingston, NJ 07039. Phone: (973) 535-1633, Fax: (973) 535-1632.
 - (2) "PWPipe" Series 46 plastic storm drain pipe, manufactured by PWPipe, 1550 Valley River Drive, Eugene OR 97401. Phone: (503) 343-0200, Fax: (503) 686-9247.
 - (3) Approved equivalent.
 2. Polyethylene material in plastic couplings: Comply with ASTM D2952.
 3. Flexible watertight joints:
 - a) Provide rubber type gaskets for concrete pipe, complying with ASTM C433 but with shore durometer hardness type A, 40-55, in lieu of the hardness specified.
 - b) Provide factory-fabricated resilient materials for clay pipe, complying with ASTM C425.
 - c) Provide gasket and jointing materials with not more than one splice, except that two splices of rubber gasket type will be permitted if the nominal diameter of the gasket exceeds 54".
 4. Joints and Fittings:
 - a) Pipe joints and fitting shall conform to AASHTO M252 and AASHTO M294, or be approved by the Engineer.
 - b) Coupling bands shall cover at least on full corrugation on each section of pipe. When gasketed couple bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D1056, Grade RE42. All coupling bands shall meet or exceed the soils tightness requirements of the AASHTO Standard Specifications for Highway Bridges, Section 23, paragraph 23.3.2.5.4.(e).
 - c) All fittings shall conform to AASHTO M294.
- B. Provide pipe and associated materials to the size indicated on the Drawings and meeting the following requirements:
1. Acrylonitrile-Butadiene-Styrene pipe (ABS):
 - a) Plastic Pipe: ANSI/ASTM D2751, SDR 35, Acrylonitrile-Butadiene Styrene (ABS) material; inside nominal diameter, bell, and spigot style solvent sealed joint end.

2.2 DRAINAGE STRUCTURES

A. General:

1. Construction inlets of reinforced concrete or precast reinforced concrete, complete with metal frames and covers or gratings, and with fixed ladder rungs where indicated on the Drawings or required by codes. Prefabricated structures may be used when shown on the plans and approved by the engineer.
2. Rungs shall be individual wall-mounted aluminum, plastic-covered steel, or galvanized steel rungs are acceptable.

B. Materials:

1. Concrete: comply with provisions for 3,250 psi concrete specified in Section 02750 Concrete Pavement.
2. Precast concrete catch basins:
 - a) Provide reinforced and bottom open for field pouring to ensure slope through the structure.
 - b) Contractor may select this option in lieu of cast-in-place concrete catch basins.
 - c) Acceptable products:
 - (1) Manufactured by Mid State Concrete Products, LLC, 1625-C East Donovan Road, Santa Maria, California 93454. Telephone: (805)928-2855, Fax (805)928-2114.
 - (2) Manufactured by Christy, 44100 Christy Street, Fremont, CA 94538. Phone: (800) 486-7070, Fax: (510) 490-6904.
 - (3) Manufactured by Central Precast Concrete Inc, 471 West College Avenue, Santa Rosa, CA 95401. Phone: (707) 546-5016, Fax: (707) 571-7768.
 - (4) Manufactured by Brooks Products, 1850 Parco Avenue, Ontario, CA 91761. Phone: (888) 307-7470, Fax: (909) 947-7741.
 - (5) Approved equivalent.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions are detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 EXCAVATING, TRENCHING, AND BEDDING

A. Trenching:

1. See Section 33 00 10 for additional requirements.
2. Excavate, trench, and bed for site drains as follows:
3. Movement construction machinery:
 - a) Use means necessary to a displacement of, and injury to, pipe and structure while compacting by rolling or operating equipment parallel to the pipe.
 - b) Movement of construction machinery over a culvert or storm drain at any stage of construction is solely at the Contractor's risk.

4. Bedding
 - a) Provide a bedding surface for the pipe with a firm foundation of uniform density throughout the entire length of the pipe.
 - b) Tamp bedding where necessary.

3.3 INSTALLATION -PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. General:
 1. Carefully examine each pipe prior to placing.
 - a) Promptly set aside defective pipe and damaged pipe.
 - b) Clearly identify defects.
 - c) Do not install defective pipe or damaged pipe.
 2. Place pipe to the grades and alignment indicated, with a tolerance of one in 1000 vertical and one in 500 horizontal, unless otherwise directed by the Engineer.
 3. Provide adequate facilities for lowering pipe safely into the trenches.
 4. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.
- C. Polyvinyl chloride pipe joints: Install with the specified materials and in accordance with the manufacturer's recommendations as approved by the Engineer, applying solvent cement to pipe and fitting as recommended in ASTM M285.
- D. Joining pipes of different materials: Provide fittings or couplings made for the pipe materials jointing, or provide a concrete collar as approved by the Engineer.
- E. Joining pipe of different sizes:
 1. Provide reducer fittings to the larger pipe.
 2. Where pipes are different materials as well as different sizes, use the same material for reducer fittings as in the larger pipe.
 3. Use saddle connection when branch lines join a main or collector main.
 4. Use eccentric collar joint when the slope of the pipe is less than 1%.
- F. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- G. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- H. Install continuous trace wire 6 inches above top of pipe.

3.4 INSTALLATION – DRAINAGE STRUCTURES

- A. Install drainage structures in accordance with the Drawings and with the manufacturer's recommendations as approved by the Engineer.

3.5 BACKFILLING

- A. Backfill and compact in accordance with pertinent provision of Section 33 00 10 – Trenching, Backfilling, and Compacting.

3.6 TESTING AND INSPECTING

- A. Provide personnel and equipment necessary, and perform tests required to demonstrate that the work of this Section has been completed in accordance with the specified requirements.

END OF SECTION

New Classroom Buildings
Dana Elementary School
Lucia Mar Unified School District
LMUSD Project No. 0606
DSA Application No. 03-125585

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