**** WARNING ** WARNING ** WARNING ** WARNING ****
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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

AND

SPECIAL PROVISIONS

FOR BUILDING CONSTRUCTION IN

SAN BERNARDINO COUNTY IN FONTANA AT THE SOUTHERN REGIONAL LABORATORY AT 13970 VICTORIA STREET

DISTRICT 08, ROUTE 5730

For Use in Connection with Standard Specifications Dated MAY 2006, Standard Plans Dated MAY 2006, and Labor Surcharge and Equipment Rental Rates.

CONTRACT NO. 08-0H2824

08-SBd-5730

Bids Open: January 31, 2008

Dated: November 19, 2007

OSD

INFORMATION HANDOUT

****

IMPORTANT SPECIAL NOTICES

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- Attention is directed to Section 3, "Award and Execution of Contract," of these special provisions regarding submittal of the documents identified in Section 3-1.025, "Insurance Policies," of the Standard Specifications.

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STANDARD PLANS LIST

The Standard Plan sheets applicable to this contract include, but are not limited to those indicated below. The Revised Standard Plans (RSP) and New Standard Plans (NSP) which apply to this contract are included as individual sheets of the project plans.

A10A	Acronyms and Abbreviations (Sheet 1 of 2)
A10B	Acronyms and Abbreviations (Sheet 2 of 2)
A10C	Symbols (Sheet 1 of 2)
A10D	Symbols (Sheet 2 of 2)
A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
A24A	Pavement Markings – Arrows
A62A	Excavation and Backfill – Miscellaneous Details
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RSP A62DA	Excavation and Backfill – Concrete Pipe Culverts
A62F	Excavation and Backfill – Metal and Plastic Culverts
A85	Chain Link Fence
RSP A87A	Curbs and Driveways
RSP A88A	Curb Ramp Details
D72	Drainage Inlets
D73	Drainage Inlets
D75A	Steel Pipe Inlets
D77A	Grate Details
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D78A	Gutter Depressions
D94A	Metal and Plastic Flared End Sections
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D97A	Corrugated Metal Pipe Coupling Details No. 1 – Annular Coupling Band Bar and Strap and Angle Connections
D97B	Corrugated Metal Pipe Coupling Details No. 2 – Hat Band Coupler and Flange Details
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D97D	Corrugated Metal Pipe Coupling Details No. 4 – Hugger Coupling Bands
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H1	Planting and Irrigation – Abbreviations
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H4	Planting and Irrigation Details
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T13	Traffic Control System for Lane Closure on Two Lane Conventional Highways
T56	Temporary Water Pollution Control Details (Temporary Fiber Roll)
T57	Temporary Water Pollution Control Details (Temporary Check Dam)
T58	Temporary Water Pollution Control Details (Temporary Construction Entrance)
T59	Temporary Water Pollution Control Details (Temporary Concrete Washout Facility)

RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs – Wood Post, Typical Installation Details No. 2
RS4	Roadside Signs, Typical Installation Details No. 4
S93	Framing Details for Framed Single Sheet Aluminum Signs, Rectangular Shape
S95	Roadside Single Sheet Aluminum Signs, Diamond Shape
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ES-8	Electrical Systems (Pull Box Details)
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ES-13B	Electrical Systems (Wiring Details and Fuse Ratings)

DEPARTMENT OF TRANSPORTATION

NOTICE TO CONTRACTORS

CONTRACT NO. 08-0H2824

08-SBd-5730-

Sealed proposals for the work shown on the plans entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROJECT PLANS FOR BUILDING CONSTRUCTION IN SAN BERNARDINO COUNTY IN FONTANA AT THE SOUTHERN REGIONAL LABORATORY AT 13970 VICTORIA STREET

will be received at the Department of Transportation, 3347 Michelson Drive, Suite 100, Irvine, CA 92612-1692, until 2 o'clock p.m. on January 31, 2008, at which time they will be publicly opened and read in Room C - 1116 at the same address.

Proposal forms for this work are included in a separate book entitled:

STATE OF CALIFORNIA; DEPARTMENT OF TRANSPORTATION; PROPOSAL AND CONTRACT FOR BUILDING CONSTRUCTION IN SAN BERNARDINO COUNTY IN FONTANA AT THE SOUTHERN REGIONAL LABORATORY AT 13970 VICTORIA STREET

General work description: Construct new buildings for the Southern Regional Laboratory.

This project has a goal of 3 percent disabled veteran business enterprise (DVBE) participation.

No prebid meeting is scheduled for this project.

Bids are required for the entire work described herein.

At the time this contract is awarded, the Contractor shall possess either a Class A license or Class B license or a combination of Class C licenses which constitutes a majority of the work.

The Contractor must also be properly licensed at the time the bid is submitted, except that on a joint venture bid a joint venture license may be obtained by a combination of licenses after bid opening but before award in conformance with Business and Professions Code, Section 7029.1.

This contract is subject to state contract nondiscrimination and compliance requirements pursuant to Government Code, Section 12990.

This project is subject to the State Small Business Preference, Non-Small Business Subcontractor Preference, and California Company Reciprocal Preference.

Inquiries or questions based on alleged patent ambiguity of the plans, specifications or estimate must be communicated as a bidder inquiry prior to bid opening. Any such inquiries or questions, submitted after bid opening, will not be treated as a bid protest.

Bidder inquiries may be made as follows:

The Department will consider bidder inquiries only when completed "Bidder Inquiry" form is submitted. A copy of the "Bidder Inquiry" form is available on the Internet at the address shown below. Submit "Bidder Inquiry" forms to:

Department of Transportation
Construction Program Duty Senior
464 West 4th Street, 6th Floor, CCO/Pre-Bid Inquiry Desk
San Bernardino, CA 92401-1400

Fax Number: (909) 383-6739
http://www.dot.ca.gov/dist8/construction

To expedite processing, submittal of "Bidder Inquiry" forms via internet is preferred.

To the extent feasible and at the discretion of the Department, completed "Bidder Inquiry" forms submitted for consideration will be investigated, and responses will be posted on the Internet at:

http://www.dot.ca.gov/dist8/construction

The responses to bidder's inquiries, unless incorporated into formal addenda to the contract, are not part of the contract and are provided for bidder's convenience only. In some instances, the question and answer may represent a summary of the matters discussed rather than a word-for-word recitation. The availability or use of information provided in the responses to bidder's inquiries is not to be construed in any way as a waiver of the provisions of Section 2-1.03 of the Standard Specifications or any other provision of the contract, the plans, Standard Specifications or Special Provisions, nor to excuse the contractor from full compliance with those contract requirements. Bidders are cautioned that subsequent to responses or contract addenda may affect or vary a response previously given.

Project plans, special provisions, and proposal forms for bidding this project can only be obtained at the Department of Transportation, Plans and Bid Documents, Room 0200, MS #26, Transportation Building, 1120 N Street, Sacramento, California 95814, FAX No. (916) 654-7028, Telephone No. (916) 654-4490. Use FAX orders to expedite orders for project plans, special provisions and proposal forms. FAX orders must include credit card charge number, card expiration date and authorizing signature. Project plans, special provisions, and proposal forms may be seen at the above Department of Transportation office and at the offices of the District Directors of Transportation at Irvine, Oakland, and the district in which the work is situated. Standard Specifications and Standard Plans are available through the State of California, Department of Transportation, Publications Unit, 1900 Royal Oaks Drive, Sacramento, CA 95815, Telephone No. (916) 445-3520.

The successful bidder shall furnish a payment bond and a performance bond.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at the Labor Compliance Office at the offices of the District Director of Transportation for the district in which the work is situated, and available from the California Department of Industrial Relations' Internet Web Site at: http://www.dir.ca.gov. Future effective general prevailing wage rates which have been predetermined and are on file with the Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

DEPARTMENT OF TRANSPORTATION

Deputy Director Transportation Engineering

Dated November 19, 2007

MAG/LLS

COPY OF ENGINEER'S ESTIMATE

(NOT TO BE USED FOR BIDDING PURPOSES)

08-0H2824

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
1	070012	PROGRESS SCHEDULE (CRITICAL PATH METHOD)	LS	LUMP SUM
2	070018	TIME-RELATED OVERHEAD	WDAY	670
3	074016	CONSTRUCTION SITE MANAGEMENT	LS	LUMP SUM
4	074019	PREPARE STORM WATER POLLUTION PREVENTION PLAN	LS	LUMP SUM
5	074028	TEMPORARY FIBER ROLL	LF	750
6	074031	TEMPORARY GRAVEL BAG BERM	LF	1,400
7	074032	TEMPORARY CONCRETE WASHOUT FACILITY	EA	1
8	074033	TEMPORARY CONSTRUCTION ENTRANCE	EA	1
9	074038	TEMPORARY DRAINAGE INLET PROTECTION	EA	6
10	074041	STREET SWEEPING	LS	LUMP SUM
11	012921	4" POLYVINYL CHLORIDE PIPE (DOMESTIC WATER SUPPLY)	LF	1,010
12	012922	10" POLYVINYL CHLORIDE PIPE (FIRE SERVICE LINE)	LF	2,310
13	012923	4" DOMESTIC WATER BACKFLOW PREVENTER ASSEMBLY	EA	1
14	012924	4" POLYVINYL CHLORIDE DRAIN PIPE	LF	840
15	012925	4" MEDIUM DENSITY POLYETHLENE GAS PIPE	LF	600
16	120090	CONSTRUCTION AREA SIGNS	LS	LUMP SUM
17	120100	TRAFFIC CONTROL SYSTEM	LS	LUMP SUM
18	170101	DEVELOP WATER SUPPLY	LS	LUMP SUM
19	200001	HIGHWAY PLANTING	LS	LUMP SUM
20	200101	IMPORTED TOPSOIL	CY	2,000

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
21	012926	DECOMPOSED GRANITE	CY	40
22	204099	PLANT ESTABLISHMENT WORK	LS	LUMP SUM
23	208000	IRRIGATION SYSTEM	LS	LUMP SUM
24	208310	IRRIGATION SLEEVE	LF	380
25	260201	CLASS 2 AGGREGATE BASE	CY	2,300
26	390102	ASPHALT CONCRETE (TYPE A)	TON	3,600
27 (F)	510502	MINOR CONCRETE (MINOR STRUCTURE)	CY	34
28	560248	FURNISH SINGLE SHEET ALUMINUM SIGN (0.063"-UNFRAMED)	SQFT	20
29	566011	ROADSIDE SIGN - ONE POST	EA	9
30	620100	18" ALTERNATIVE PIPE CULVERT	LF	17
31	620140	24" ALTERNATIVE PIPE CULVERT	LF	1,520
32	703223	24" CORRUGATED STEEL PIPE RISER (.079" THICK)	LF	10
33	707051	DRAINAGE MANHOLE	EA	3
34	012927	8" POLYVINYL CHLORIDE DRAINAGE PIPE	LF	870
35	012928	8" SLOTTED POLYVINYL CHLORIDE RISER PIPE	LF	93
36	012929	6" VITRIFIED CLAY PIPE (SEWER)	LF	1,090
37	012930	6" SANITARY SEWER LATERAL CLEANOUT	EA	1
38	719200	SEWER MANHOLE	EA	2
39	012931	MINOR CONCRETE (6" CURB)	CY	84
40	012932	MINOR CONCRETE (8" CURB)	CY	34

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
41	731516	MINOR CONCRETE (DRIVEWAY)	CY	70
42	731521	MINOR CONCRETE (SIDEWALK)	CY	490
43	012933	MINOR CONCRETE (6" CURB AND GUTTER)	CY	62
44	012934	MINOR CONCRETE (SWALE)	CY	58
45	012935	MINOR CONCRETE (MOTORCYCLE PARKING)	CY	12
46	012936	SITE IDENTIFICATION SIGN	EA	4
47 (F)	750001	MISCELLANEOUS IRON AND STEEL	LB	1,410
48	800360	CHAIN LINK FENCE (TYPE CL-6)	LF	1,180
49	012937	6' ORNAMENTAL STEEL FENCE	LF	470
50	012938	4' ORNAMENTAL STEEL PEDESTRIAN SWING GATE	EA	4
51	012939	4' 8" ORNAMENTAL STEEL PEDESTRIAN SWING GATE	EA	1
52	012940	6' 8" ORNAMENTAL STEEL PEDESTRIAN SWING GATE	EA	1
53	012941	8' 8" ORNAMENTAL STEEL VEHICULAR SWING GATE	EA	2
54	012942	12' ORNAMENTAL STEEL VEHICULAR SWING GATE	EA	1
55	012943	30' ORNAMENTAL STEEL DOUBLE SWING GATE	EA	1
56	012944	30' ORNAMENTAL STEEL ROLLING GATE	EA	1
57	012945	DIGIAL ENTRY ELECTRONIC GATE CONTROL	EA	2
58	840656	PAINT TRAFFIC STRIPE (2-COAT)	LF	2,100
59	840660	PAINT PAVEMENT MARKING	SQFT	430
60	012946	PAINT PAVING MARKING (BLUE)	SQFT	84

Item No.	Item Code	Item Description	Unit of Measure	Estimated Quantity
61	842000	PARKING BUMPER (PRECAST CONCRETE)	EA	68
62	012947	SITE LIGHTING	LS	LUMP SUM
63	012948	SITE ELECTRICAL	LS	LUMP SUM
64	012949	SITE GRADING	SQYD	18,000
65	012950	FIRE HYDRANT ASSEMBLY	EA	7
66	012951	10" FIRE SERVICE BACKFLOW PREVENTER ASSEMBLY	EA	1
67	012952	PIPE BOLLARD	EA	4
68	012953	POST INDICATOR VALVE	EA	1
69	994650	BUILDING WORK	LS	LUMP SUM

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

Annexed to Contract No. 08-0H2824

SECTION 1. SPECIFICATIONS AND PLANS

The work embraced herein shall conform to the provisions in the Standard Specifications dated May 2006 and the Standard Plans dated May 2006 of the Department of Transportation insofar as the same may apply and these special provisions.

AMENDMENTS TO MAY 2006 STANDARD SPECIFICATIONS

UPDATED OCTOBER 19, 2007

SECTION 0: GLOBAL REVISIONS

Issue Date: August 17, 2007

Blank

SECTION 1: DEFINITIONS AND TERMS

Issue Date: October 19, 2007

Section 1-1.01, "General," of the Standard Specifications is amended by adding the following:

- The Department is gradually changing the style and language of the specifications. The new style and language includes:

1. Use of:

    1.1. Imperative mood
    1.2. Introductory modifiers
    1.3. Conditional clauses

2. Elimination of:

    2.1. Language variations
    2.2. Definitions for industry-standard terms
    2.3. Redundant specifications
    2.4. Needless cross-references

- The use of this new style does not change the meaning of a specification not yet using this style.
- The specifications are written to the Bidder before award and the Contractor after. Before award, interpret sentences written in the imperative mood as starting with "The Bidder must" and interpret "you" as "the Bidder" and "your" as "the Bidder's." After award, interpret sentences written in the imperative mood as starting with "The Contractor must" and interpret "you" as "the Contractor" and "your" as "the Contractor's."

- Unless an object or activity is specified to be less than the total, the quantity or amount is all of the object or activity.
- All items in a list apply unless the items are specified as choices.
- Interpret terms as defined in the Contract documents. A term not defined in the Contract documents has the meaning defined in Means Illustrated Construction Dictionary, Condensed Version, Second Edition.

The 1st table in Section 1-1.02, "Abbreviations," of the Standard Specifications is amended by adding:

SSPC	The Society for Protective Coatings

Section 1, "Definitions and Terms," of the Standard Specifications is amended by adding the following sections:

1-1.082 BUSINESS DAY

- Day on the calendar except Saturday or holiday.

1-1.084 CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

- The California Manual on Uniform Traffic Control Devices for Streets and Highways (California MUTCD) is issued by the Department of Transportation and is the Federal Highway Administration's MUTCD 2003 Edition, as amended for use in California.

1-1.125 DEDUCTION

- Amount of money permanently taken from progress payment and final payment. Deductions are cumulative and are not retentions under Pub Cont Code § 7107.

1-1.205 FEDERAL-AID CONTRACT

- Contract that has a Federal-aid project number on the cover of the Notice to Contractors and Special Provisions.

1-1.245 HOLIDAY

1. Every Sunday
2. January 1st, New Year's Day
3. 3rd Monday in January, Birthday of Martin Luther King, Jr.
4. February 12th, Lincoln's Birthday
5. 3rd Monday in February, Washington's Birthday
6. March 31st, Cesar Chavez Day
7. Last Monday in May, Memorial Day
8. July 4th, Independence Day
9. 1st Monday in September, Labor Day
10. 2nd Monday in October, Columbus Day
11. November 11th, Veterans Day
12. 4th Thursday in November, Thanksgiving Day
13. 4th Friday in November, Day after Thanksgiving Day
14. December 25th, Christmas Day

- If January 1st, February 12th, March 31st, July 4th, November 11th, or December 25th falls on a Sunday, the Monday following is a holiday. If November 11th falls on a Saturday, the preceding Friday is a holiday.

1-1.475 WITHHOLD

- Money temporarily or permanently taken from progress payment. Withholds are cumulative and are not retentions under Pub Cont Code § 7107.

Section 1-1.255, "Legal Holidays," of the Standard Specifications is deleted.

Section 1-1.265, "Manual on Uniform Traffic Control Devices," of the Standard Specifications is deleted.

Section 1-1.266, "Manual on Uniform Traffic Control Devices California Supplement," of the Standard Specifications is deleted.

Section 1-1.39 "State," of the Standard Specifications is amended to read:

1-1.39 STATE

• The State of California, including its agencies, departments, or divisions, whose conduct or action is related to the work.

SECTION 3: AWARD AND EXECUTION OF CONTRACT

Issue Date: August 17, 2007

Section 3-1.025, "Insurance Policies," of the Standard Specifications is amended to read:

3-1.025 INSURANCE POLICIES

• The successful bidder shall submit:

1. Copy of its commercial general liability policy and its excess policy or binder until such time as a policy is available, including the declarations page, applicable endorsements, riders, and other modifications in effect at the time of contract execution. Standard ISO form No. CG 0001 or similar exclusions are allowed if not inconsistent with Section 7-1.12, "Indemnification and Insurance." Allowance of additional exclusions is at the discretion of the Department.
2. Certificate of insurance showing all other required coverages. Certificates of insurance, as evidence of required insurance for the auto liability and any other required policy, shall set forth deductible amounts applicable to each policy and all exclusions that are added by endorsement to each policy. The evidence of insurance shall provide that no cancellation, lapse, or reduction of coverage will occur without 10 days prior written notice to the Department.
3. A declaration under the penalty of perjury by a certified public accountant certifying the accountant has applied Generally Accepted Accounting Principles (GAAP) guidelines confirming the successful bidder has sufficient funds and resources to cover any self-insured retentions if the self-insured retention is $50,000 or higher.

• If the successful bidder uses any form of self-insurance for workers compensation in lieu of an insurance policy, it shall submit a certificate of consent to self-insure in accordance with the provisions of Section 3700 of the Labor Code.

Section 3-1.03, "Execution of Contract," of the Standard Specifications is amended to read:

3-1.03 EXECUTION OF CONTRACT

• The contract shall be signed by the successful bidder and returned, together with the contract bonds and the documents identified in Section 3-1.025, "Insurance Policies," within 10 business days of receiving the contract for execution.

Section 3-1.04, "Failure to Execute Contract," of the Standard Specifications is amended to read:

3-1.04 FAILURE TO EXECUTE CONTRACT

• Failure of the lowest responsible bidder, the second lowest responsible bidder, or the third lowest responsible bidder to execute the contract as required in Section 3-1.03, "Execution of Contract," within 10 business days of receiving the contract for execution shall be just cause for the forfeiture of the proposal guaranty. The successful bidder may file with the Department a written notice, signed by the bidder or the bidder's authorized representative, specifying that the bidder will refuse to execute the contract if it is presented. The filing of this notice shall have the same force and effect as the failure of the bidder to execute the contract and furnish acceptable bonds within the time specified.

Section 3-1.05, "Return of Proposal Guaranties," of the Standard Specifications is amended to read:

3-1.05 RETURN OF PROPOSAL GUARANTIES

• The Department keeps the proposal guaranties of the 1st, 2nd and 3rd lowest responsible bidders until the contract has been executed. The other bidders' guaranties, other than bidders' bonds, are returned upon determination of the 1st, 2nd, and 3rd apparent lowest bidders, and their bidders' bonds are of no further effect.

SECTION 4: SCOPE OF WORK

Issue Date: August 17, 2007

Section 4-1.01, "Intent of Plans and Specifications," of the Standard Specifications is amended by adding the following:

- Nothing in the specifications voids the Contractor's public safety responsibilities.

SECTION 5: CONTROL OF WORK

Issue Date: October 19, 2007

Section 5, "Control of Work," of the Standard Specifications is amended by adding the following sections:

5-1.005 GENERAL

- Failure to comply with any specification part is a breach of the contract and a waiver of your right to time or payment adjustment.
- After contract approval, submit documents and direct questions to the Engineer. Orders, approvals, and requests to the Contractor are by the Engineer.
- The Engineer furnishes the following in writing:

1. Approvals
2. Notifications
3. Orders

- The Contractor must furnish the following in writing:

1. Assignments
2. Notifications
3. Proposals
4. Requests, sequentially numbered
5. Subcontracts
6. Test results

- The Department rejects a form if it has any error or any omission.
- Convert foreign language documents to English.
- Use contract administration forms available at the Department's Web site.
- If the last day for submitting a document falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

5-1.015 RECORD RETENTION, INSPECTION, COPYING, AND AUDITING

- Retain project records and make them available for inspection, copying, and auditing by State representatives from bid preparation through:

1. Final payment
2. Resolution of claims, if any

- For at least 3 years after the later of these, retain and make available for inspection, copying, and auditing cost records by State representatives including:

1. Records pertaining to bid preparation
2. Overhead
3. Payroll records and certified payroll
4. Payments to suppliers and subcontractors
5. Cost accounting records
6. Records of subcontractors and suppliers

- Maintain the records in an organized way in the original format, electronic and hard copy, conducive to professional review and audit.
- Before contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier 5 days before inspection, copying, or auditing.
- If an audit is to start more than 30 days after contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier when the audit is to start.

Section 5-1.01, "Authority of Engineer," of the Standard Specifications is amended by adding:

- Failure to enforce a contract provision does not waive enforcement of any contract provision.

Section 5-1.04, "Coordination and Interpretation of Plans, Standard Specifications, and Special Provisions," of the Standard Specifications is amended to read:

5-1.04 CONTRACT COMPONENTS

- A component in one contract part applies as if appearing in each. The parts are complementary and describe and provide for a complete work.
- If a discrepancy exists:

1. The governing ranking of contract parts in descending order is:

    1.1. Special provisions
    1.2. Project plans
    1.3. Revised Standard Plans
    1.4. Standard Plans
    1.5. Amendments to the Standard Specifications
    1.6. Standard Specifications
    1.7. Project information

2. Written numbers and notes on a drawing govern over graphics
3. A detail drawing governs over a general drawing
4. A detail specification governs over a general specification
5. A specification in a section governs over a specification referenced by that section

- If a discrepancy is found or confusion arises, request correction or clarification.

Section 5-1.07, "Lines and Grades," of the Standard Specifications is replaced with the following:

5-1.07 LINES AND GRADES

- The Engineer places stakes and marks under Chapter 12, "Construction Surveys," of the Department's Surveys Manual.
- Submit your request for Department-furnished stakes:

1. On a Request for Construction Stakes form. Ensure:

    1.1. Requested staking area is ready for stakes
    1.2. You use the stakes in a reasonable time

2. A reasonable time before starting an activity using the stakes

- Establish priorities for stakes and note priorities on the request.
- Preserve stakes and marks placed by the Engineer. If the stakes or marks are destroyed, the Engineer replaces them at the Engineer's earliest convenience and deducts the cost.

SECTION 6: CONTROL OF MATERIALS

Issue Date: August 17, 2007

Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications is amended to read:

6-1.05 Specific Brand or Trade Name and Substitution

- A reference to a specific brand or trade name establishes a quality standard and is not intended to limit competition. You may use a product that is equal to or better than the specified brand or trade name if approved.
- Submit a substitution request within a time period that:

1. Follows Contract award
2. Allows 30 days for review
3. Causes no delay

- Include substantiating data with the substitution request that proves the substitution:

1. Is of equal or better quality and suitability
2. Causes no delay in product delivery and installation

Section 6, "Control of Materials," of the Standard Specifications is amended by adding the following sections:

6-1.085 BUY AMERICA (23 CFR 635.410)

- For a Federal-aid contract, furnish steel and iron materials to be incorporated into the work that are produced in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials [60 Fed Reg 15478 (03/24/1995)]
2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or $2,500, material produced outside the United States may be used

- Production includes:

1. Processing steel and iron materials, including smelting or other processes that alter the physical form or shape (such as rolling, extruding, machining, bending, grinding, and drilling) or chemical composition
2. Coating application, including epoxy coating, galvanizing, and painting, that protects or enhances the value of steel and iron materials

- For steel and iron materials to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications that certifies all production processes occurred in the United States except for the above exceptions.

6-1.087 BUY AMERICA (PUB RES CODE § 42703(d))

- Furnish crumb rubber to be incorporated into the work that is produced in the United States and is derived from waste tires taken from vehicles owned and operated in the United States.
- For crumb rubber to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the Standard Specifications that certifies only crumb rubber manufactured in the United States and derived from waste tires taken from vehicles owned and operated in the United States is used.

The 7th and 8th paragraph of Section 6-2.01, "General," of the Standard Specifications are amended to read:

- Upon the Contractor's written request, the Department tests materials from an untested local source. If satisfactory material from that source is used in the work, the Department does not charge the Contractor for the tests; otherwise, the Department deducts the test cost.

The 2nd sentence of the 7th paragraph of Section 6-2.02, "Possible Local Material Sources," of the Standard Specifications is amended to read:

- The Department deducts the charges for the removed material.

SECTION 7: LEGAL RELATIONS AND RESPONSIBILITIES

Issue Date: August 17, 2007

Section 7-1.01, "Laws To Be Observed," of the Standard Specifications is amended to read:

7-1.01 LAWS TO BE OBSERVED

- Comply with laws, orders, decrees, and permits. Indemnify and defend the State against any claim or liability arising from the violation of a law, order, decree, or permit by you or your employees. Immediately report to the Engineer in writing a discrepancy or inconsistency between the contract and a law, order, decree, or permit.

The 3rd listed requirement of the 1st paragraph of Section 7-1.01A(2), "Prevailing Wage," of the Standard Specifications is amended to read:

3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the Contractor must diligently take corrective action to stop or rectify the failure, including withholding sufficient funds due the subcontractor for work performed on the public works project.

The 2nd paragraph of Section 7-1.01A(2), "Prevailing Wage," of the Standard Specifications is amended to read:

- Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement must notify the Contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the Department did not withhold sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the Contractor must withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor must pay any money withheld from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works project, whichever occurs later, the Contractor must pay all moneys withheld from the subcontractor to the Department. The Department withholds these moneys pending the final decision of an enforcement action.

The 2nd paragraph of Section 7-1.01A(3), "Payroll Records," of the Standard Specifications is amended to read:

- The Department withholds the penalties specified in subdivision (g) of Labor Code § 1776 for noncompliance with the requirements in Section 1776.

The 4th paragraph of Section 7-1.01A(3), "Payroll Records," of the Standard Specifications is amended to read:

- The Department withholds for delinquent or inadequate payroll records (Labor Code § 1771.5). If the Contractor has not submitted an adequate payroll record by the month's 15th day for the period ending on or before the 1st of that month, the Department withholds 10 percent of the monthly progress estimate, exclusive of mobilization. The Department does not withhold more than $10,000 or less than $1,000.

The 5th paragraph of Section 7-1.01A(3), "Payroll Records," of the Standard Specifications is deleted.

Section 7-1.01A(6), "Workers' Compensation," of the Standard Specifications is amended to read:

7-1.101A(6) (Blank)

The first sentence of the eighth paragraph of Section 7-1.09, "Public Safety," of the Standard Specifications is amended to read:

• Signs, lights, flags, and other warning and safety devices and their use shall conform to the requirements set forth in Part 6 of the California MUTCD.

The sixteenth paragraph of Section 7-1.09, "Public Safety," of the Standard Specifications is amended to read:

• When vertical clearance is temporarily reduced to 15.5 feet or less, low clearance warning signs shall be placed in accordance with Part 2 of the California MUTCD and as directed by the Engineer. Signs shall conform to the dimensions, color, and legend requirements of the California MUTCD and these specifications except that the signs shall have black letters and numbers on an orange retroreflective background. W12-2P signs shall be illuminated so that the signs are clearly visible.

The last sentence of the 2nd paragraph of Section 7-1.11, "Preservation of Property," of the Standard Specifications is amended to read:

• The cost of the repairs must be borne by the Contractor and will be deducted.

Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications is amended to read:

7-1.12 INDEMNIFICATION AND INSURANCE

• The Contractor's obligations regarding indemnification of the State of California and the requirements for insurance shall conform to the provisions in Section 3-1.025, "Insurance Policies," and Sections 7-1.12A, "Indemnification," and 7-1.12B, "Insurance," of this Section 7-1.12.

7-1.12A Indemnification

• The Contractor shall defend, indemnify, and save harmless the State, including its officers, employees, and agents (excluding agents who are design professionals) from any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, losses or liabilities, in law or in equity (Section 7-1.12A Claims) arising out of or in connection with the Contractor's performance of this contract for:

1. Bodily injury including, but not limited to, bodily injury, sickness or disease, emotional injury or death to persons, including, but not limited to, the public, any employees or agents of the Contractor, the State, or any other contractor; and
2. Damage to property of anyone including loss of use thereof; caused or alleged to be caused in whole or in part by any negligent or otherwise legally actionable act or omission of the Contractor or anyone directly or indirectly employed by the Contractor or anyone for whose acts the Contractor may be liable.

• Except as otherwise provided by law, these requirements apply regardless of the existence or degree of fault of the State. The Contractor is not obligated to indemnify the State for Claims arising from conduct delineated in Civil Code Section 2782 and to Claims arising from any defective or substandard condition of the highway that existed at or before the start of work, unless this condition has been changed by the work or the scope of the work requires the Contractor to maintain existing highway facilities and the Claim arises from the Contractor's failure to maintain. The Contractor's defense and indemnity obligation shall extend to Claims arising after the work is completed and accepted if the Claims are directly related to alleged acts or omissions by the Contractor that occurred during the course of the work. State inspection is not a waiver of full compliance with these requirements.

• The Contractor's obligation to defend and indemnify shall not be excused because of the Contractor's inability to evaluate liability or because the Contractor evaluates liability and determine that the Contractor is not liable. The Contractor shall respond within 30 days to the tender of any Claim for defense and indemnity by the State, unless this time has been extended by the State. If the Contractor fails to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, the Department may withhold such funds the State reasonably considers necessary for its defense and indemnity until disposition has been made of the Claim or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

• With respect to third-party claims against the Contractor, the Contractor waives all rights of any type to express or implied indemnity against the State, its officers, employees, or agents (excluding agents who are design professionals).

• Nothing in the Contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these indemnification specifications.

7-1.12B Insurance

7-1.12B(1) General

• Nothing in the contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these insurance specifications.

7-1.12B(2) Casualty Insurance

• The Contractor shall procure and maintain insurance on all of its operations with companies acceptable to the State as follows:

1. The Contractor shall keep all insurance in full force and effect from the beginning of the work through contract acceptance.
2. All insurance shall be with an insurance company with a rating from A.M. Best Financial Strength Rating of A- or better and a Financial Size Category of VII or better.
3. The Contractor shall maintain completed operations coverage with a carrier acceptable to the State through the expiration of the patent deficiency in construction statute of repose set forth in Code of Civil Procedure Section 337.1.

7-1.12B(3) Workers' Compensation and Employer's Liability Insurance

• In accordance with Labor Code Section 1860, the Contractor shall secure the payment of worker's compensation in accordance with Labor Code Section 3700.

• In accordance with Labor Code Section 1861, the Contractor shall submit to the Department the following certification before performing the work:

> I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

• Contract execution constitutes certification submittal.

• The Contractor shall provide Employer's Liability Insurance in amounts not less than:

1. $1,000,000 for each accident for bodily injury by accident
2. $1,000,000 policy limit for bodily injury by disease
3. $1,000,000 for each employee for bodily injury by disease

• If there is an exposure of injury to the Contractor's employees under the U.S. Longshoremen's and Harbor Workers' Compensation Act, the Jones Act, or under laws, regulations, or statutes applicable to maritime employees, coverage shall be included for such injuries or claims.

7-1.12B(4) Liability Insurance

7-1.12B(4)(a) General

• The Contractor shall carry General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability and property damage liability for the following limits and including coverage for:

1. Premises, operations, and mobile equipment
2. Products and completed operations
3. Broad form property damage (including completed operations)
4. Explosion, collapse, and underground hazards
5. Personal injury
6. Contractual liability

7-1.12B(4)(b) Liability Limits/Additional Insureds

• The limits of liability shall be at least the amounts shown in the following table:

Total Bid	For Each Occurrence[1]	Aggregate for Products/Completed Operation	General Aggregate[2]	Umbrella or Excess Liability[3]
≤$1,000,000	$1,000,000	$2,000,000	$2,000,000	$5,000,000
>$1,000,000 ≤$5,000,000	$1,000,000	$2,000,000	$2,000,000	$10,000,000
>$5,000,000 ≤$25,000,000	$2,000,000	$2,000,000	$4,000,000	$15,000,000
>$25,000,000	$2,000,000	$2,000,000	$4,000,000	$25,000,000

1. Combined single limit for bodily injury and property damage.
2. This limit shall apply separately to the Contractor's work under this contract.
3. The umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

• The Contractor shall not require certified Small Business subcontractors to carry Liability Insurance that exceeds the limits in the table above. Notwithstanding the limits specified herein, at the option of the Contractor, the liability insurance limits for certified Small Business subcontractors of any tier may be less than those limits specified in the table. For Small Business subcontracts, "Total Bid" shall be interpreted as the amount of subcontracted work to a certified Small Business.

• The State, including its officers, directors, agents (excluding agents who are design professionals), and employees, shall be named as additional insureds under the General Liability and Umbrella Liability Policies with respect to liability arising out of or connected with work or operations performed by or on behalf of the Contractor under this contract. Coverage for such additional insureds does not extend to liability:

1. Arising from any defective or substandard condition of the roadway which existed at or before the time the Contractor started work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing roadway facilities and the claim arises from the Contractor's failure to maintain;
2. For claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor that occurred during the course of the work; or
3. To the extent prohibited by Insurance Code Section 11580.04

• Additional insured coverage shall be provided by a policy provision or by an endorsement providing coverage at least as broad as Additional Insured (Form B) endorsement form CG 2010, as published by the Insurance Services Office (ISO), or other form designated by the Department.

7-1.12B(4)(c) Contractor's Insurance Policy is Primary

• The policy shall stipulate that the insurance afforded the additional insureds applies as primary insurance. Any other insurance or self-insurance maintained by the State is excess only and shall not be called upon to contribute with this insurance.

7-1.12B(5) Automobile Liability Insurance

• The Contractor shall carry automobile liability insurance, including coverage for all owned, hired, and nonowned automobiles. The primary limits of liability shall be not less than $1,000,000 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required under Section 7-1.12B(4)(b) also applies to automobile liability.

7-1.12B(6) Policy Forms, Endorsements, and Certificates

• The Contractor shall provide its General Liability Insurance under Commercial General Liability policy form No. CG0001 as published by the Insurance Services Office (ISO) or under a policy form at least as broad as policy form No. CG0001.

7-1.12B(7) Deductibles

• The State may expressly allow deductible clauses, which it does not consider excessive, overly broad, or harmful to the interests of the State. Regardless of the allowance of exclusions or deductions by the State, the Contractor is responsible for any deductible amount and shall warrant that the coverage provided to the State is in accordance with Section 7-1.12B, "Insurance."

7-1.12B(8) Enforcement

• The Department may assure the Contractor's compliance with its insurance obligations. Ten days before an insurance policy lapses or is canceled during the contract period, the Contractor shall submit to the Department evidence of renewal or replacement of the policy.

• If the Contractor fails to maintain any required insurance coverage, the Department may maintain this coverage and withhold or charge the expense to the Contractor or terminate the Contractor's control of the work in accordance with Section 8-1.08, "Termination of Control."

• The Contractor is not relieved of its duties and responsibilities to indemnify, defend, and hold harmless the State, its officers, agents, and employees by the Department's acceptance of insurance policies and certificates.

• Minimum insurance coverage amounts do not relieve the Contractor for liability in excess of such coverage, nor do they preclude the State from taking other actions available to it, including the withholding of funds under this contract.

7-1.12B(9) Self-Insurance

• Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the State.

• If the Contractor uses a self-insurance program or self-insured retention, the Contractor shall provide the State with the same protection from liability and defense of suits as would be afforded by first-dollar insurance. Execution of the contract is the Contractor's acknowledgement that the Contractor will be bound by all laws as if the Contractor were an insurer as defined under Insurance Code Section 23 and that the self-insurance program or self-insured retention shall operate as insurance as defined under Insurance Code Section 22.

SECTION 8: PROSECUTION AND PROGRESS

Issue Date: August 17, 2007

The 2nd paragraph of Section 8-1.02, "Assignment," of the Standard Specifications is amended to read:

• If the Contractor assigns the right to receive contract payments, the Department accepts the assignment upon the Engineer's receipt of a notice. Assigned payments remain subject to deductions and withholds described in the contract. The Department may use withheld payments for work completion whether payments are assigned or not.

SECTION 9: MEASUREMENT AND PAYMENT

Issue Date: August 17, 2007

The last sentence of the 1st paragraph of Section 9-1.02, "Scope of Payment," of the Standard Specifications is amended to read:

• Neither the payment of any estimate nor of any retained percentage or withhold relieves the Contractor of any obligation to make good any defective work or material.

The 6th paragraph of Section 9-1.03C, "Records," of the Standard Specifications is deleted.

The 2nd sentence of the 14th paragraph of Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications is amended to read:

• Administrative disputes are disputes of administrative deductions or withholds, contract item quantities, contract item adjustments, interest payments, protests of contract change orders as provided in Section 4-1.03A, "Procedure and Protest," and protests of the Weekly Statement of Working Days as provided in Section 8-1.06, "Time of Completion."

Section 9-1.05, "Stop Notices," of the Standard Specifications is amended to read:

9-1.05 STOP NOTICE WITHHOLDS

• The Department may withhold payments to cover claims filed under Civ Code § 3179 et seq.

Section 9, "Measurement and Payment," of the Standard Specifications is amended by adding the following sections:

9-1.053 PERFORMANCE FAILURE WITHHOLDS

- During each estimate period you fail to comply with a contract part, including submittal of a document as specified, the Department withholds a part of the progress payment. The documents include quality control plans, schedules, traffic control plans, and water pollution control submittals.
- For 1 performance failure, the Department withholds 25 percent of the progress payment but does not withhold more than 10 percent of the total bid.
- For multiple performance failures, the Department withholds 100 percent of the progress payment but does not withhold more than 10 percent of the total bid.
- The Department returns performance-failure withholds in the progress payment following the correction of noncompliance.

9-1.055 PENALTY WITHHOLDS

- Penalties include fines and damages that are proposed, assessed, or levied against you or the Department by a governmental agency or citizen lawsuit. Penalties are also payments made or costs incurred in settling alleged permit violations of Federal, State, or local laws, regulations, or requirements. The cost incurred may include the amount spent for mitigation or correcting a violation.
- If you or the Department is assessed a penalty, the Department may withhold the penalty amount until the penalty disposition has been resolved. The Department may withhold penalty funds and notify you within 15 days of the withhold. If the penalty amount is less than the amount being withheld from progress payments for retentions, the Department will not withhold the penalty amount.
- If the penalty is resolved for less than the amount withheld, the Department pays interest at a rate of 6 percent per year on the excess withhold. If the penalty is not resolved, the withhold becomes a deduction.
- Instead of the withhold, you may provide a bond payable to the Department of Transportation equal to the highest estimated liability for any disputed penalties proposed.

9-1.057 PROGRESS WITHHOLDS FOR FEDERAL-AID CONTRACTS

- Section 9-1.057, "Progress Withholds for Federal-Aid Contracts," applies to a Federal-aid contract.
- The Department withholds 10 percent of a partial payment for noncompliant progress. Noncompliant progress occurs when:

1. Total days to date exceed 75 percent of the revised contract working days
2. Percent of working days elapsed exceeds the percent of value of work completed by more than 15 percent

- The Engineer determines the percent of working days elapsed by dividing the total days to date by the revised contract working days and converting the quotient to a percentage.
- The Engineer determines the percent of value of work completed by summing payments made to date and the amount due on the current progress estimate, dividing this sum by the current total estimated value of the work, and converting the quotient to a percentage. These amounts are shown on the Progress Payment Voucher.
- When the percent of working days elapsed minus the percent of value of work completed is less than or equal to 15 percent, the Department returns the withhold in the next progress payment.

The 3rd paragraph of Section 9-1.06, "Partial Payments," of the Standard Specifications is amended to read:

- For a non-Federal-aid project, the Department retains 10 percent of the estimated value of the work done and 10 percent of the value of materials estimated to have been furnished and delivered and unused or furnished and stored as part security for the fulfillment of the contract by the Contractor, except that at any time after 20 percent of the work has been completed, if the Engineer finds that satisfactory progress is being made, the Department may reduce the total amount being retained from payment pursuant to the above requirements to 5 percent of the total estimated value of the work and materials and may also reduce the amount retained from any of the remaining partial payments to 5 percent of the estimated value of the work and materials. In addition, on any partial payment made after 95 percent of the work has been completed, the Department may reduce the amount retained from payment pursuant to the requirements of this Section 9-1.06, to such lesser amount as the Department determines is adequate security for the fulfillment of the balance of the work and other requirements of the contract, but in no event is that amount reduced to less than 125 percent of the estimated value of the work yet to be completed as determined by the Engineer. The reduction is made only upon the request of the Contractor and must be approved in writing by the surety on the performance bond and by the surety on the payment bond. The approval of the surety must be submitted to the Disbursing Officer of the Department; the signature of the person executing the approval for the surety must be properly acknowledged and the power of attorney authorizing the person to give that consent must

either accompany the document or be on file with the Department. The retentions specified in this paragraph are those defined in Pub Cont Code § 7107(b).

The 1st sentence of the 4th paragraph of Section 9-1.06, "Partial Payments," of the Standard Specifications is amended to read:

• The Department shall pay monthly to the Contractor, while carrying on the work, the balance not retained, as aforesaid, after deducting therefrom all previous payments and all sums to be deducted or withheld under the provisions of the contract.

The title and 1st and 2nd paragraphs of Section 9-1.065, "Payment of Withheld Funds," of the Standard Specifications are amended to read:

9-1.065 RELEASE OF RETAINED FUNDS

• The Department releases retained funds if you:

1. Request release of the retention (Pub Cont Code § 10263) in writing
2. Deposit securities equivalent to the funds you want released into escrow with the State Treasurer or with a bank acceptable to the Department
3. Are the beneficial owner of and receive interest on the deposited securities substituted for the retained funds

The 2nd sentence Section 9-1.07A, "Payment Prior to Proposed Final Estimate," of the Standard Specifications is amended to read:

• The Department pays the balance due less previous payments, deductions, withholds, and retentions under the provisions of the contract and those further amounts that the Engineer determines to be necessary pending issuance of the proposed final estimate and payment thereon.

The 1st paragraph of Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications is amended to read:

• After acceptance by the Director, the Engineer makes a proposed final estimate of the total amount payable to the Contractor, including an itemization of the total amount, segregated by contract item quantities, extra work, and other basis for payment, and shows each deduction made or to be made for prior payments and amounts to be deducted, withheld, or retained under the provisions of the contract. Prior estimates and payments are subject to correction in the proposed final estimate. The Contractor must submit written approval of the proposed final estimate or a written statement of claims arising under or by virtue of the contract so that the Engineer receives the written approval or statement of claims no later than close of business of the 30th day after receiving the proposed final estimate. The Contractor's receipt of the proposed final estimate must be evidenced by postal receipt. The Engineer's receipt of the Contractor's written approval or statement of claims must be evidenced by postal receipt or the Engineer's written receipt if delivered by hand.

SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Issue Date: October 6, 2006

The first sentence of the second paragraph of Section 12-1.01, "Description," of the Standard Specifications is amended to read:

• Attention is directed to Part 6 of the California MUTCD.

Section 12-2.01, "Flaggers," of the Standard Specifications is amended to read:

12-2.01 FLAGGERS

• Flaggers while on duty and assigned to traffic control or to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in conformance with Part 6 of the California MUTCD. The equipment shall be furnished and kept clean and in good repair by the Contractor at the Contractor's expense.

The first paragraph of Section 12-3.01, "General," of the Standard Specifications is amended to read:

• In addition to the requirements in Part 6 of the California MUTCD, all devices used by the Contractor in the performance of the work shall conform to the provisions in this Section 12-3.

The second sentence of the first paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• Construction area signs are shown in or referred to in Part 6 of the California MUTCD.

The first sentence of the fourth paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• All construction area signs shall conform to the dimensions, color and legend requirements of the plans, Part 6 of the California MUTCD and these specifications.

The first sentence of the eighth paragraph of Section 12-3.06, "Construction Area Signs," of the Standard Specifications is amended to read:

• Used signs with the specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and the colors conform to the requirements in Part 6 of the California MUTCD.

SECTION 19: EARTHWORK

Issue Date: January 5, 2007

The first paragraph of Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications is amended to read:

• Cementitious material used in soil cement bedding shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

The fourth paragraph of Section 19-3.025C, "Soil Cement Bedding," of the Standard Specifications is amended to read:

• The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Soil cement bedding shall contain not less than 282 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

The first paragraph of Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications is amended to read:

• Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cementitious material, and water.

The fifth paragraph of Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications is amended to read:

• Cementitious material shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

The eighth paragraph of Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications is amended to read:

• The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Slurry cement backfill shall contain not less than 188 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

SECTION 20: EROSION CONTROL AND HIGHWAY PLANTING

Issue Date: August 17, 2007

Section 20-2.03, "Soil Amendment," of the Standard Specifications is amended to read:

20-2.03 SOIL AMENDMENT

- Soil amendment shall comply with the requirements in the California Food and Agricultural Code.
- Soil amendment producers shall comply with the following:

1. Be fully permitted to produce compost as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
2. Be a participant in United States Composting Council's Seal of Testing Assurance program.

- Soil amendment shall be composted and may be derived from any single, or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

- Soil amendment feedstock materials shall be composted to reduce weed seeds, pathogens and deleterious materials as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.
- Soil amendment shall not be derived from mixed municipal solid waste and must be reasonably free of visible contaminates. Soil amendment must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Soil amendment must not possess objectionable odors.
- Metal concentrations in soil amendment must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
- Soil amendment must comply with the following:

Physical/Chemical Requirements

Property	Test Method	Requirement
pH	*TMECC 04.11-A, Elastometric pH 1:5 Slurry Method, pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A, Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A, Total Solids & Moisture at 70+/- 5 deg C, % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A, Loss-On-Ignition Organic Matter Method (LOI), % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A, Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B, Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	95% Passing 5/8 inch 70% Passing 3/8 inch
Pathogen	TMECC 07.01-B, Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B, Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Plastic, Glass and Metal, % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles), % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

- Prior to application, the Contractor shall provide the Engineer with a copy of the soil amendment producer's Compost Technical Data Sheet and a copy of the compost producers STA certification. The Compost Technical Data Sheet shall include laboratory analytical test results, directions for product use, and a list of product ingredients.
- Prior to application, the Contractor shall provide the Engineer with a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

The last 3 paragraphs of Section 20-2.10, "Seed," of the Standard Specifications are deleted.

The last paragraph of Section 20-3.04A, "General," of the Standard Specifications is deleted.

Section 20-4.055, "Pruning," of the Standard Specifications is amended to read:

20-4.055 PRUNING

- Pruning of plants shall be consistent with American National Standards Institute (ANSI), "Tree, Shrub and Other Woody Plant Maintenance Standard Practices," ANSI 300 (Part 1)-2001 and "Best Management Practices Tree Pruning," 2002 (ISBN 1-881956318), published by the International Society of Arboriculture, P.O. Boc 3129, Champaign, IL 61826.

SECTION 25: AGGREGATE SUBBASES

Issue Date: February 16, 2007

The first paragraph of Section 25-1.02A, "Class 1, Class 2, and Class 3 Aggregate Subbases," of the Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

The first paragraph of Section 25-1.02B, "Class 4 Aggregate Subbase," of the Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

SECTION 26: AGGREGATE BASE

Issue Date: February 16, 2007

The first paragraph of Section 26-1.02A, "Class 2 Aggregate Base," of the Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

The first paragraph of Section 26-1.02B, "Class 3 Aggregate Base," of the Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

SECTION 27: CEMENT TREATED BASES

Issue Date: January 5, 2007

The first paragraph of Section 27-1.02, "Materials," of the Standard Specifications is amended to read:

- Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The third paragraph of Section 27-1.02, "Materials," of the Standard Specifications is amended to read:

- Aggregate for use in Class A cement treated base shall be of such quality that when mixed with cement in an amount not to exceed 5 percent by weight of the dry aggregate and compacted at optimum moisture content, the compressive strength of a sample of the compacted mixture shall not be less than 750 pounds per square inch at 7 days, when tested by California Test 312.

The fourth paragraph of Section 27-1.02, "Materials," of the Standard Specifications is amended to read:

- Aggregate for use in Class B cement treated base shall have a Resistance (R-value) of not less than 60 before mixing with cement and a Resistance (R-value) of not less than 80 after mixing with cement in an amount not to exceed 2.5 percent by weight of the dry aggregate.

SECTION 28: LEAN CONCRETE BASE

Issue Date: January 5, 2007

The first paragraph of Section 28-1.02, "Materials," of the Standard Specifications is amended to read:

- Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The sixth paragraph of Section 28-1.02, "Materials," of the Standard Specifications is amended to read:

- Aggregate shall be of such quality that, when mixed with cement in an amount not to exceed 300 pounds per cubic yard, and tested in conformance with the requirements in California Test 548, the compressive strength of a sample will be not less than 700 pounds per square inch at 7 days.

SECTION 29: TREATED PERMEABLE BASES

Issue Date: January 5, 2007

The second paragraph of Section 29-1.02B, "Cement Treated Permeable Base," of the Standard Specifications is amended to read:

- Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The second paragraph of Section 29-1.04B, "Cement Treated Permeable Base," of the Standard Specifications is amended to read:

- Cement treated permeable base shall contain not less than 287 pounds of cement per cubic yard.

SECTION 37: BITUMINOUS SEALS

Issue Date: August 17, 2007

The fourth through sixth paragraphs in Section 37-1.03, "Maintaining Traffic," of the Standard Specifications are amended to read:

- On 2-lane two-way roadways, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to both sides of the traveled way where screenings are being spread on a traffic lane. The first W8-7 sign in each direction shall be placed where traffic first encounters loose screenings, regardless of which lane the screenings are being spread on. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along each side of the traveled way and at public roads or streets entering the seal coat area as directed by the Engineer.
- On multilane roadways (freeways, expressways and multilane conventional highways) where screenings are being spread on a traffic lane, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to the outside edge of the traveled way nearest to the lane being worked on. The first W8-7 sign shall be placed where the screenings begin with respect to the direction of travel on that lane. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along the edge of traveled way and at on-ramps, public roads or streets entering the seal coat area as directed by the Engineer.
- The W8-7 and W13-1 signs shall be maintained in place at each location until final brooming of the seal coat surface at that location is completed. The W8-7 and W13-1 signs shall conform to the provisions for construction area signs in Section 12, "Construction Area Traffic Control Devices." The signs may be set on temporary portable supports with the W13-1 below the W8-7 or on barricades with the W13-1 sign alternating with the W8-7 sign.

The second paragraph in Section 37-1.09, "Payment," of the Standard Specifications is amended to read:

- The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in applying seal coat, complete in place, including furnishing, placing, maintaining, and removing W8-7 and W13-1 signs, when required, and temporary supports or barricades for the signs, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 40: PORTLAND CEMENT CONCRETE PAVEMENT

Issue Date: January 5, 2007

Section 40-1.015, "Cement Content," is deleted.

Section 40-1.05, "Proportioning," of the Standard Specifications is amended to read:

- Aggregate and cementitious material proportioning shall conform to the provisions in Section 90-5, "Proportioning."

The first paragraph in Section 40-1.105, "Exit Ramp Termini," of the Standard Specifications is amended to read:

- Concrete pavement shall be constructed at the ends of exit ramps when required by the plans or the special provisions. Texturing for exit ramp termini shall be by means of heavy brooming in a direction normal to ramp centerline. The hardened surface shall have a coefficient of friction not less than 0.35 as determined by California Test 342. Minimum cementitious material content of concrete in pavement for exit ramp termini shall be 590 pounds per cubic yard.

The first paragraph in Section 40-1.14, "Payment," of the Standard Specifications is amended to read:

- The contract price paid per cubic yard for concrete pavement shall include full compensation for furnishing all labor, materials (including cementitious material in the amount specified), tools, equipment, and incidentals, and for doing all the work involved in constructing the portland cement concrete pavement, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 41: PAVEMENT SUBSEALING AND JACKING

Issue Date: January 5, 2007

The second paragraph of Section 41-1.02, "Materials," of the Standard Specifications is amended to read:

- Cement for grout shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The third paragraph of Section 41-1.02, "Materials," of the Standard Specifications is amended to read:

- Fly ash shall conform to the requirements in AASHTO Designation: M 295 for either Class C or for Class F. The brand of fly ash used in the work shall conform to the provisions for approval of admixture brands in Section 90-4.03, "Admixture Approval."

The fifth paragraph of Section 41-1.02, "Materials," of the Standard Specifications is amended to read:

- Chemical admixtures and calcium chloride may be used. Chemical admixtures in the grout mix shall conform to the provisions in Section 90-4, "Admixtures." Calcium chloride shall conform to ASTM Designation: D 98.

SECTION 49: PILING

Issue Date: January 5, 2007

The first sentence of the sixth paragraph of Section 49-1.03, "Determination of Length," of the Standard Specifications is amended to read:

- Indicator compression pile load testing shall conform to the requirements in ASTM Designation: D 1143-81.

The first sentence of the seventh paragraph of Section 49-1.03, "Determination of Length," of the Standard Specifications is amended to read:

- Indicator tension pile load testing shall conform to the requirements in ASTM Designation: D 3689-90.

The sixth paragraph in Section 49-1.04, "Load Test Piles," of the Standard Specifications is amended to read:

- The Contractor may use additional cementitious material in the concrete for the load test and anchor piles.

SECTION 50: PRESTRESSING CONCRETE

Issue Date: January 5, 2007

The seventh paragraph in Section 50-1.07, "Ducts," of the Standard Specifications is amended to read:

- All ducts with a total length of 400 feet or more shall be vented. Vents shall be placed at intervals of not more than 400 feet and shall be located within 6 feet of every high point in the duct profile. Vents shall be 1/2 inch minimum diameter standard pipe or suitable plastic pipe. Connections to ducts shall be made with metallic or plastic structural fasteners. Plastic components, if selected, shall not react with the concrete or enhance corrosion of the prestressing steel and shall be free of water soluble chlorides. The vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents. Ends of vents shall be removed one inch below the roadway surface after grouting has been completed.

Item B of the eleventh paragraph in Section 50-1.08, "Prestressing," of the Standard Specifications is amended to read:

B. When the concrete is designated by class or cementitious material content, either the concrete compressive strength shall have reached the strength shown on the plans at the time of stressing or at least 28 days shall have elapsed since the last concrete to be prestressed has been placed, whichever occurs first.

The second and third paragraphs in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications are amended to read:

- Grout shall consist of cement and water and may contain an admixture if approved by the Engineer.
- Cement shall conform to the provisions in Section 90-2.01A, "Cement."

The first paragraph in Section 50-1.11, "Payment," of the Standard Specifications is amended to read:

- No separate payment will be made for pretensioning precast concrete members. Payment for pretensioning precast concrete members shall be considered as included in the contract price paid for furnish precast members as provided for in Section 51, "Concrete Structures."

SECTION 51: CONCRETE STRUCTURES

Issue Date: October 5, 2007

The first sentence of the eleventh paragraph of Section 51-1.05, "Forms," of the Standard Specifications is amended to read:

- Form panels for exposed surfaces shall be furnished and placed in uniform widths of not less than 3 feet and in uniform lengths of not less than 6 feet, except at the end of continuously formed surfaces where the final panel length required is less than 6 feet.

The first sentence of the eleventh paragraph of Section 51-1.06C, "Removing Falsework," of the Standard Specifications is amended to read:

- Falsework for box culverts and other structures with decks lower than the roadway pavement and with span lengths of 14 feet or less shall not be released until the last placed concrete has attained a compressive strength of 1,600 psi, provided that curing of the concrete is not interrupted.

The fourth paragraph in Section 51-1.12D, "Sheet Packing, Preformed Pads, and Board Fillers," of the Standard Specifications is amended to read:

- Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a minimum flexural strength of 35 psi determined in conformance with the requirements in ASTM Designation: C 203 and a compressive yield strength of between 16 and 40 psi at 5 percent compression. Surfaces of expanded polystyrene against which concrete is placed shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to ANSI A135.4, any class. Other facing materials may be used provided they furnish equivalent protection. Boards shall be held in place by nails, waterproof adhesive, or other means approved by the Engineer.

The 3rd paragraph of Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended to read:

- Type A and AL joint seals shall consist of a groove in the concrete that is filled with field-mixed silicone sealant.

The table in the 6th paragraph of Section 51-1.12F, "Sealed Joints," of the Standard Specifications is amended to read:

Movement Rating (MR)	Seal Type
MR ≤ 1 inch	Type A or Type B
1 inch < MR ≤ 2 inches	Type B
2 inches < MR ≤ 4 inches	Joint Seal Assembly (Strip Seal)
MR > 4 inches	Joint Seal Assembly (Modular Unit) or Seismic Joint

The 1st paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal, " of the Standard Specifications is amended to read:

- The sealant must consist of a 2-component silicone sealant that will withstand up to ±50 percent movement.

The 2nd paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the Standard Specifications is amended to read:

- Silicone sealants must be tested under California Test 435 and must comply with the following:

Specification	Requirement
Modulus at 150 percent elongation	8–75 psi
Recovery	21/32 inch max.
Notch Test	Notched or loss of bond 1/4 inch, max.
Water Resistance	Notched or loss of bond 1/4 inch, max.
Ultraviolet Exposure ASTM Designation: G 154, Table X2.1,Cycle 2.	No more than slight checking or cracking.
Cone Penetration	4.5-12.0 mm

The 3rd paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the Standard Specifications is deleted.

The 8th paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the Standard Specifications is deleted.

The 10th paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the Standard Specifications is amended to read:

- A Certificate of Compliance accompanied by a certified test report must be furnished for each batch of silicone sealant in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

The 2nd paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the Standard Specifications is amended to read:

- The preformed elastomeric joint seal must conform to the requirements in ASTM D 2628 and the following:

1. The seal must consist of a multichannel, nonporous, homogeneous material furnished in a finished extruded form.
2. The minimum depth of the seal measured at the contact surface must be at least 95 percent of the minimum uncompressed width of the seal as designated by the manufacturer.
3. When tested in conformance with the requirements in California Test 673 for Type B seals, joint seals must provide a movement rating (MR) of not less than that shown on the plans.
4. The top and bottom edges of the joint seal must maintain continuous contact with the sides of the groove over the entire range of joint movement.
5. The seal must be furnished full length for each joint with no more than 1 shop splice in any 60-foot length of seal.
6. The Contractor must demonstrate the adequacy of the procedures to be used in the work before installing seals in the joints.
7. One field splice per joint may be made at locations and by methods approved by the Engineer. The seals are to be manufactured full length for the intended joint, then cut at the approved splice section and rematched before splicing. The Contractor must submit splicing details prepared by the joint seal manufacturer for approval before beginning splicing work.
8. Shop splices and field splices must have no visible offset of exterior surfaces and must show no evidence of bond failure.
9. At all open ends of the seal that would admit water or debris, each cell must be filled to a depth of 3 inches with commercial quality open cell polyurethane foam or closed by other means subject to approval by the Engineer.

The 7th paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the Standard Specifications is amended to read:

- The joint seal must be installed full length for each joint with equipment that does not twist or distort the seal, elongate the seal longitudinally, or otherwise cause damage to the seal or to the concrete forming the groove.

The first sentence of the eleventh paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the Standard Specifications is amended to read:

- Samples of the prefabricated joint seals, not less than 3 feet in length, will be taken by the Engineer from each lot of material.

The fourth and fifth sentences of the sixth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the Standard Specifications are amended to read:

• Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each thread direction when 3" x 36" samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 20 pounds per inch.

The hardness (Type A) requirement in the table in the eighth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the Standard Specifications is amended to read:

Hardness (Type A)	D 2240 with 2kg mass.	55 ±5

The first sentence of subparagraph A of the first paragraph of Section 51-1.12H(2), "Steel Reinforced Elastomeric Bearings," of the Standard Specifications is amended to read:

• The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 0.075 inch (14 gage).

The first paragraph in Section 51-1.135, "Mortar," of the Standard Specifications is amended to read:

• Mortar shall be composed of cementitious material, sand, and water proportioned and mixed as specified in this Section 51-1.135.

The third paragraph in Section 51-1.135, "Mortar," of the Standard Specifications is amended to read:

• The proportion of cementitious material to sand, measured by volume, shall be one to 2 unless otherwise specified.

The third sentence of the fourth paragraph of Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications is amended to read:

• The surfaces shall have a profile trace showing no high points in excess of 0.25 inch, and the portions of the surfaces within the traveled way shall have a profile count of 5 or less in any 100-foot section.

Section 51-1.17, "Finishing Bridge Decks," of the Standard Specifications is amended by adding the following subsection:

51-1.17A DECK CRACK TREATMENT

• The Contractor shall use all means necessary to minimize the development of shrinkage cracks.

• The Contractor shall remove all equipment and materials from the deck and clean the surface as necessary for the Engineer to measure the surface crack intensity. Surface crack intensity will be determined by the Engineer after completion of concrete cure, before prestressing, and before the release of falsework. In any 500 square foot portion of deck within the limits of the new concrete deck, should the intensity of cracking be such that there are more than 16 feet of cracks whose width at any location exceeds 0.02 inch, the deck shall be treated with methacrylate resin. The area of deck to be treated shall have a width that extends for the entire width of new deck inside the concrete barriers and a length that extends at least 5 feet beyond the furthest single continuous crack outside the 500 square foot portion, measured from where that crack exceeds 0.02 inch in width, as determined by the Engineer.

• Deck crack treatment shall include furnishing, testing, and application of methacrylate resin and sand. If grinding is required, deck treatment shall take place before grinding.

51-1.17A(1) Submittals

• Before starting deck treatment, the Contractor shall submit plans in conformance with Section 5-1.02, "Plans and Working Drawings," for the following:

1. Public safety plan for the use of methacrylate resin
2. Placement plan for the construction operation

• The plans shall identify materials, equipment, and methods to be used.

- The public safety plan for the use of methacrylate resin shall include details for the following:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual methacrylate resin and the containers

- The placement plan for construction shall include the following:

1. Schedule of deck treatment for each bridge. The schedule shall be consistent with "Maintaining Traffic" of the special provisions and shall include time for the Engineer to perform California Test 342.
2. Methods and materials to be used, including the following:

    2.1. Description of equipment for applying the resin
    2.2. Description of equipment for applying the sand
    2.3. Gel time range and final cure time for the resin

- If the measures proposed in the safety plan are inadequate to provide for public safety associated with the use of methacrylate resin, the Engineer will reject the plan and direct the Contractor to revise the plan. Directions for revisions will be in writing and include detailed comments. The Engineer will notify the Contractor of the approval or rejection of a submitted or revised plan within 15 days of receipt of that plan.
- In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

51-1.17A(2) Materials

- Before using methacrylate resin, a Material Safety Data Sheet shall be submitted for each shipment of resin.
- Methacrylate resin shall be low odor and have a high molecular weight. Before adding initiator, the resin shall have a maximum volatile content of 30 percent when tested in conformance with the requirements in ASTM Designation: D 2369, and shall conform to the following:

PROPERTY	REQUIREMENT	TEST METHOD
* Viscosity	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F	ASTM D 2196
* Specific Gravity	0.90 minimum, at 77°F	ASTM D 1475
* Flash Point	180°F, minimum	ASTM D 3278
* Vapor Pressure	1.0 mm Hg, maximum, at 77°F	ASTM D 323
Tack-free Time	400 minutes, maximum at 25°C	Specimen prepared per California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1°C	California Test 551
* Test shall be performed before adding initiator.		

51-1.17A(3) Testing

- The Contractor shall allow 20 days for sampling and testing by the Engineer of the methacrylate resin before proposed use. If bulk resin is to be used, the Contractor shall notify the Engineer in writing at least 15 days before the delivery of the bulk resin to the job site. Bulk resin is any resin stored in containers in excess of 55 gallons.

- Before starting production treatment, the Contractor shall treat a test area of approximately 500 square feet that is within the project limits and at a location approved by the Engineer. When available the test area shall be outside of the traveled way. Weather and pavement conditions during the test treatment shall be similar to those expected on the deck. Equipment used for testing shall be similar to those used for deck treating operations.
- During test and production deck treatment, test tiles shall be used to evaluate the resin cure time. The Contractor shall coat at least one 4" x 4" commercial quality smooth glazed tile for each batch of methacrylate resin. The coated tile shall be placed adjacent to the corresponding treated area. Sand shall not be applied to the test tiles.
- The acceptance criteria for a treated area is as follows:

1. The test tiles are dry to the touch.
2. The treated deck surface is tack free (non-oily).
3. The sand cover adheres and resists brushing by hand.
4. Excess sand has been removed by vacuuming or sweeping.
5. The coefficient of friction is at least 0.35 when tested in conformance with California Test 342.

- Deck treatment on the test area shall demonstrate that the methods and materials meet the acceptance criteria and that the production work will be completed within the specified time for maintaining traffic.
- If a test or production area fails to meet the acceptance criteria, as determined by the Engineer, the treatment will be rejected, and the treatment shall be removed and replaced until the area complies with the acceptance criteria.

51-1.17A(4) Construction

- Equipment shall be fitted with suitable traps, filters, drip pans, or other devices as necessary to prevent oil or other deleterious material from being deposited on the deck.
- Before deck treatment with methacrylate resin, the bridge deck surface shall be cleaned by abrasive blasting, and all loose material shall be blown from visible cracks using high-pressure air. Concrete curing seals shall be cleaned from the deck surface to be treated, and the deck shall be dry when blast cleaning is performed. If the deck surface becomes contaminated at any time before placing the resin, the deck surface shall be cleaned by abrasive blasting.
- Where abrasive blasting is being performed within 10 feet of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the abrasive and the surface being treated. The removal shall be by a vacuum attachment operating concurrently with the abrasive blasting operation.
- A compatible promoter/initiator system shall be capable of providing the resin gel time range shown on the placement plan. Gel time shall be adjusted to compensate for the changes in temperature throughout treatment application.
- Resin shall be applied by machine and by using a two-part resin system with a promoted resin for one part and an initiated resin for the other part. This two-part resin system shall be combined at equal volumes to the spray bars through separate positive displacement pumps. Combining of the 2 components shall be by either static in-line mixers or by external intersecting spray fans. The pump pressure at the spray bars shall not be great enough to cause appreciable atomization of the resin. Compressed air shall not be used to produce the spray. A shroud shall be used to enclose the spray bar apparatus.
- At the Contractor's option, manual application may be used. For manual application, (1) the quantity of resin mixed with promoter and initiator shall be limited to 5 gallons at a time, and (2) the resin shall be distributed by squeegees and brooms within 10 minutes after application.
- The Contractor shall apply methacrylate resin only to the specified area. Barriers, railing, joints, and drainage facilities shall be adequately protected to prevent contamination by the treatment material. Contaminated items shall be repaired at the Contractor's expense.
- The relative humidity shall be less than 90 percent at the time of treatment. The prepared area shall be dry and the surface temperature shall be at least 50°F and not more than 100°F when the resin is applied. The rate of application of promoted/initiated resin shall be approximately 90 square feet per gallon; the exact rate shall be determined by the Engineer.
- The deck surfaces to be treated shall be completely covered with resin so the resin penetrates and fills all cracks. The resin shall be applied within 5 minutes after complete mixing. A significant increase in viscosity shall be cause for rejection. Excess material shall be redistributed by squeegees or brooms within 10 minutes after application. For textured deck surfaces, including grooved surfaces, excess material shall be removed from the texture indentations.
- After the resin has been applied, at least 20 minutes shall elapse before applying sand. The sand shall be commercial quality dry blast sand. At least 95 percent of the sand shall pass the No. 8 sieve and at least 95 percent shall be retained on the No. 20 sieve. The sand shall be applied at a rate of approximately 2 pounds per square yard or until refusal as determined by the Engineer.
- Traffic will not be allowed on treated areas until the acceptance criteria has been met as determined by the Engineer.

The second paragraph in Section 51-1.18C, "Class 2 Surface Finish (Gun Finish)," of the Standard Specifications is amended to read:

• When Class 2 surface finish (gun finish) is specified, ordinary surface finish shall first be completed. The concrete surfaces shall then be abrasive blasted to a rough texture and thoroughly washed down with water. While the washed surfaces are damp, but not wet, a finish coating of machine applied mortar, approximately 1/4 inch thick, shall be applied in not less than 2 passes. The coating shall be pneumatically applied and shall consist of either (1) sand, cementitious material, and water mechanically mixed prior to its introduction to the nozzle, or (2) premixed sand and cementitious material to which water is added prior to its expulsion from the nozzle. The use of admixtures shall be subject to the approval of the Engineer as provided in Section 90, "Portland Cement Concrete." Unless otherwise specified, supplementary cementitious materials will not be required. The proportion of cementitious material to sand shall be not less than one to 4, unless otherwise directed by the Engineer. Sand shall be of a grading suitable for the purpose intended. The machines shall be operated and the coating shall be applied in conformance with standard practice. The coating shall be firmly bonded to the concrete surfaces on which it is applied.

The fifth paragraph in Section 51-1.18C, "Class 2 Surface Finish (Gun Finish)," of the Standard Specifications is amended to read:

• When surfaces to be finished are in pedestrian undercrossings, the sand shall be silica sand and the cementitious material shall be standard white portland cement.

Section 51-1.23, "Payment," of the Standard Specifications is amended by adding the following:

• Full compensation for deck crack treatment, including execution of the public safety plan, shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge, and no additional compensation will be allowed therefor.

SECTION 52: REINFORCEMENT

Issue Date: May 30, 2006

The table in the eleventh paragraph of Section 52-1.07, "Placing," of the Standard Specifications is amended to read:

Height Zone (H) (Feet above ground)	Wind Pressure Value (psf)
$H \leq 30$	20
$30 < H \leq 50$	25
$50 < H \leq 100$	30
$H > 100$	35

The table in the second paragraph of Section 52-1.08B(1), "Mechanical Splices," of the Standard Specifications is amended to read:

Reinforcing Bar Number	Total Slip
4	0.010-inch
5	0.010-inch
6	0.010-inch
7	0.014-inch
8	0.014-inch
9	0.014-inch
10	0.018-inch
11	0.018-inch
14	0.024-inch
18	0.030-inch

The subparagraph under the sixth paragraph of Section 52-1.08B(2), "Butt Welded Splices," of the Standard Specifications is amended to read:

- The minimum preheat and interpass temperatures shall be 400º F for Grade 40 bars and 600º F for Grade 60 bars. Immediately after completing the welding, at least 6 inches of the bar on each side of the splice shall be covered by an insulated wrapping to control the rate of cooling. The insulated wrapping shall remain in place until the bar has cooled below 200º F.

The first sentence of the fifth paragraph of Section 52-1.08C, "Service Splice and Ultimate Butt Splice Testing Requirements," of the Standard Specifications is amended to read:

- Prequalification and production sample splices shall be 1) a minimum length of 5 feet for reinforcing bars No. 9 and smaller, and 6.5 feet for reinforcing bars No. 10 and larger, with the splice located at mid-point; and 2) suitably identified before shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals.

The second sentence of the second paragraph of Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," of the Standard Specifications is amended to read:

- Control bars shall be 1) a minimum length of 5 feet for reinforcing bars No. 9 and smaller, and 6.5 feet for reinforcing bars No. 10 and larger, and 2) suitably identified before shipment with weatherproof markings that do not interfere with the Engineer's tamper-proof markings or seals.

SECTION 53: SHOTCRETE

Issue Date: January 5, 2007

The third paragraph in Section 53-1.01, "Description," of the Standard Specifications is amended to read:

- The dry-mix process shall consist of delivering dry mixed aggregate and cementitious material pneumatically or mechanically to the nozzle body and adding water and mixing the materials in the nozzle body. The wet-mix process shall consist of delivering mixed aggregate, cement, and water pneumatically to the nozzle and adding any admixture at the nozzle.

The first through fourth paragraphs in Section 53-1.02, "Materials," of the Standard Specifications is amended to read:

- Cementitious material, fine aggregate, and mixing water shall conform to the provisions in Section 90, "Portland Cement Concrete."
- Shotcrete to be mixed and applied by the dry-mix process shall consist of one part cementitious material to not more than 4.5 parts fine aggregate, thoroughly mixed in a dry state before being charged into the machine. Measurement may be either by volume or by weight. The fine aggregate shall contain not more than 6 percent moisture by weight.
- Shotcrete to be mixed and applied by the wet-mix process shall consist of cementitious material, fine aggregate, and water and shall contain not less than 632 pounds of cementitious material per cubic yard. A maximum of 30 percent pea gravel may be substituted for fine aggregate. The maximum size of pea gravel shall be such that 100 percent passes the 1/2 inch screen and at least 90 percent passes the 3/8 inch screen.
- Admixtures may be added to shotcrete and shall conform to the provisions in Section 90-4, "Admixtures."

Item C of the third paragraph in Section 53-1.04, "Placing Shotcrete," of the Standard Specifications is amended to read:

C. Aggregate and cementitious material that have been mixed for more than 45 minutes shall not be used unless otherwise permitted by the Engineer.

SECTION 55: STEEL STRUCTURES

Issue Date: January 5, 2007

The CVN impact value for Grade HPS 50W in the table in the fifth paragraph of Section 55-2.01, "Description," of the Standard Specifications is amended to read:

Grade HPS 50W* (4 inches and under in thickness)	20 at 10º F

The first paragraph in Section 55-3.05, "Flatness of Faying and Bearing Surfaces," of the Standard Specifications is amended to read:

• Surfaces of bearing and base plates and other metal surfaces that are to come in contact with each other or with ground concrete surfaces or with asbestos sheet packing shall be flat to within 1/32-inch tolerance in 12 inches and to within 1/16-inch tolerance overall. Surfaces of bearing and base plates and other metal bearing surfaces that are to come in contact with preformed fabric pads, elastomeric bearing pads, or mortar shall be flat to within 1/8-inch tolerance in 12 inches and to within 3/16-inch tolerance overall.

Item B of the first paragraph of Section 55-3.10, "Fastener Threads," of the Standard Specifications is amended to read:

B. Internal threads shall conform to the requirements in ASTM Designation: A 563.

The third paragraph in Section 55-3.19, "Bearings and Anchorages," of the Standard Specifications is amended to read:

• Immediately before setting bearing assemblies or masonry plates directly on ground concrete surfaces, the Contractor shall thoroughly clean the surfaces of the concrete and the metal to be in contact and shall apply a coating of nonsag polysulfide or polyurethane caulking conforming to the requirements in ASTM Designation: C 920 to contact areas to provide full bedding.

The fifth paragraph in Section 55-3.19, "Bearings and Anchorages," of the Standard Specifications is amended to read:

• Mortar to be placed below masonry plates or bearing plates of the bearing assemblies and in anchor bolt sleeves or canisters shall conform to the provisions in Section 51-1.135, "Mortar," except that the proportion of cementitious material to sand shall be 1:3.

Item D of the first paragraph of Section 55-4.01, "Measurement," of the Standard Specifications is amended to read:

D. To determine the pay quantities of galvanized metal, the weight to be added to the calculated weight of the base metal for the galvanizing will be determined from the table of weights of zinc coatings specified in ASTM Designation: A 153/A 153M.

SECTION 56: SIGNS

Issue Date: March 16, 2007

The fifth paragraph in Section 56-1.03, "Fabrication," of the Standard Specifications is amended to read:

• Clips, eyes, or removable brackets shall be affixed to all signs and all posts and shall be used to secure the sign during shipping and for lifting and moving during erection as necessary to prevent damage to the finished galvanized or painted surfaces. Brackets on tubular sign structures shall be removed after erection. Details of the devices shall be shown on the working drawings.

The fourth paragraph of Section 56-1.10, "Payment," of the Standard Specifications is amended to read:

• The contract price paid per pound for install sign structure of the type or types designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing sign structures, complete in place, including installing anchor bolt assemblies, removable sign panel frames, and sign panels and performing any welding, painting or galvanizing required during installation, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The fourth paragraph in Section 56-2.03, "Construction," of the Standard Specifications is amended to read:

• Backfill material for metal posts shall consist of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," and shall contain not less than 463 pounds of cementitious material per cubic yard.

SECTION 59: PAINTING

Issue Date: May 1, 2006

The third paragraph of Section 59-2.12, "Painting," of the Standard Specifications is amended to read:

• Contact surfaces of stiffeners, railings, built up members or open seam exceeding 6 mils in width that would retain moisture, shall be caulked with polysulfide or polyurethane sealing compound conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O, or other approved material.

The fourth paragraph of Section 59-2.12, "Painting," of the Standard Specifications is amended to read:

• The dry film thickness of the paint will be measured in place with a calibrated Type 2 magnetic film thickness gage in conformance with the requirements in SSPC-PA 2, "Measurement of Dry Coating Thickness with Magnetic Gages," of the "SSPC: The Society for Protective Coatings," except that there shall be no limit to the number or location of spot measurements to verify compliance with specified thickness requirements.

SECTION 64: PLASTIC PIPE

Issue Date: January 5, 2007

The first paragraph of Section 64-1.06, "Concrete Backfill," of the Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

SECTION 65: REINFORCED CONCRETE PIPE

Issue Date: January 5, 2007

The first paragraph of Section 65-1.02, "Materials," of the Standard Specifications is amended to read:

• Cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials" except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplemental cementitious material shall conform to AASHTO Designation: M 170.

Subparagraph "c" of the eleventh paragraph of Section 65-1.02A(1) "Circular Reinforced Concrete Pipe (Designated or Selected by Class)," of the Standard Specifications is amended to read:

c. Cementitious material and aggregate for non-reinforced concrete pipe shall conform to the provisions in Section 65-1.02, "Materials."

The first paragraph of Section 65-1.035, "Concrete Backfill," of the Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete in conformance with the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item.

The first subparagraph of the second paragraph of Section 65-1.06, "Joints," of the Standard Specifications is amended to read:

Cement Mortar.- Mortar shall be composed of one part cementitious material and 2 parts sand by volume. Supplementary cementitious material will not be required.

SECTION 66: CORRUGATED METAL PIPE

Issue Date: January 5, 2007

The first paragraph of Section 66-1.045, "Concrete Backfill," of the Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

SECTION 68: SUBSURFACE DRAINS

Issue Date: January 5, 2007

The first and second paragraphs of Section 68-3.02D, "Miscellaneous," of the Standard Specifications are amended to read:

• Concrete for splash pads shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

• Mortar placed where edge drain outlets and vents connect to drainage pipe and existing drainage inlets shall conform to the provisions in Section 51-1.135, "Mortar."

SECTION 70: MISCELLANEOUS FACILITIES

Issue Date: January 5, 2007

The second paragraph of Section 70-1.02C, "Flared End Sections," of the Standard Specifications is amended to read:

• Precast concrete flared end sections shall conform to the requirements for Class III Reinforced Concrete Pipe in AASHTO Designation: M 170M. Cementitious materials and aggregate shall conform to the provisions in Section 90-2, "Materials," except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170. The area of steel reinforcement per meter of flared end section shall be at least equal to the minimum steel requirements for circular reinforcement in circular pipe for the internal diameter of the circular portion of the flared end section. The basis of acceptance of the precast concrete flared end section shall conform to the requirements of Section 5.1.2 of AASHTO Designation: M 170.

The first paragraph of Section 70-1.02H, "Precast Concrete Structures," of the Standard Specifications is amended to read:

• Precast concrete pipe risers and pipe reducers, and precast concrete pipe sections, adjustment rings and tapered sections for pipe energy dissipators, pipe inlets and pipe manholes shall conform to the requirements in AASHTO Designation: M 199M/M 199, except that the cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials," except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170.

The second paragraph of Section 70-1.03, "Installation," of the Standard Specifications is amended to read:

• Cutoff walls for precast concrete flared end sections shall be constructed of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

SECTION 73: CONCRETE CURBS AND SIDEWALKS

Issue Date: January 5, 2007

The second subparagraph of the second paragraph of Section 73-1.01, "Description," of the Standard Specifications is amended to read:

2. Minor concrete shall contain not less than 463 pounds of cementitious material per cubic yard except that when extruded or slip-formed curbs are constructed using 3/8-inch maximum size aggregate, minor concrete shall contain not less than 548 pounds of cementitious material per cubic yard.

SECTION 75: MISCELLANEOUS METAL

Issue Date: August 17, 2007

The last sentence of the thirteenth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

• Thread dimensions for internally threaded concrete anchorage devices shall conform to the requirements in ASTM Designation: A 563.

The twenty-fourth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications is amended to read:

• Sealing compound, for caulking and adhesive sealing, shall be a polysulfide or polyurethane material conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O.

Item C of the fourth paragraph of Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications is amended to read:

C. Nuts shall conform to the requirements in ASTM Designation: A 563 including Appendix X1, except lubrication is not required.

The 1st sentence of the 3rd paragraph of Section 75-1.035, "Bridge Joint Restrainer Units." of the Standard Specifications is amended to read:

Cables shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

The twelfth paragraph in Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications is amended to read:

• Concrete for filling cable drum units shall conform to the provisions in Section 90-10, "Minor Concrete," or at the option of the Contractor, may be a mix with 3/8-inch maximum size aggregate and not less than 675 pounds of cementitious material per cubic yard.

The sixth paragraph of Section 75-1.05, "Galvanizing," of the Standard Specifications is amended to read:

• Galvanizing of iron and steel hardware and nuts and bolts, when specified or shown on the plans, shall conform to the requirements in ASTM Designation: A 153/A 153M, except whenever threaded studs, bolts, nuts, and washers are specified to conform to the requirements in ASTM Designation: A 307, A 325, A 449, A 563, or F 436 and zinc coating is required, they shall be hot-dip zinc coated or mechanically zinc coated in conformance with the requirements in the ASTM Designations. Unless otherwise specified, galvanizing shall be performed after fabrication.

The eighth paragraph of Section 75-1.05, "Galvanizing," of the Standard Specifications is amended to read:

• Tapping of nuts or other internally threaded parts to be used with zinc coated bolts, anchor bars or studs shall be done after galvanizing and shall conform to the requirements for thread dimensions and overtapping allowances in ASTM Designation: A 563.

SECTION 80: FENCES

Issue Date: January 5, 2007

The fourth paragraph of Section 80-3.01F, "Miscellaneous," of the Standard Specifications is amended to read:

• Portland cement concrete for metal post and brace footings and for deadmen shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

The fourth paragraph of Section 80-4.01C, "Miscellaneous," of the Standard Specifications is amended to read:

• Portland cement concrete for metal post and for deadmen shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

SECTION 83: RAILINGS AND BARRIERS

Issue Date: August 17, 2007

The seventh paragraph in Section 83-1.02, "Materials and Construction," of the Standard Specifications is amended to read:

• Mortar shall conform to the provisions in Section 51-1.135, "Mortar," and shall consist of one part by volume of cementitious material and 3 parts of clean sand.

The 1st sentence of the 8th subparagraph of the 24th paragraph of Section 83-1.02B, "Metal Beam Guard Railing," of the Standard Specifications is amended to read:

Anchor cable shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

Item b of the first paragraph in Section 83-2.02D(2), "Materials," of the Standard Specifications is amended to read:

b. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip-formed concrete barriers, the cementitious material content of the minor concrete shall be not less than 675 pounds per cubic yard.

The third paragraph in Section 83-2.02D(2), "Materials," of the Standard Specifications is amended to read:

• The concrete paving between the tops of the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) and the optional concrete slab at the base between the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) shall be constructed of minor concrete conforming to the provisions of Section 90-10, "Minor Concrete," except that the minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

The 2nd sentence of the 6th paragraph of Section 83-1.02E, "Cable Railing," of the Standard Specifications is amended to read:

Cable shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

The 5th paragraph of Section 83-1.02I, "Chain Link Railing," of the Standard Specifications is amended to read:

Where shown on the plans, cables used in the frame shall be 5/16 inch in diameter, wire rope, with a minimum breaking strength of 5,000 pounds and shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

The 14th paragraph of Section 83-1.02I, "Chain Link Railing," of the Standard Specifications is amended to read:

Chain link fabric shall be either 11-gage Type I zinc-coated fabric conforming to the requirements in AASHTO M 181 or 11-gage Type IV polyvinyl chloride (PVC) coated fabric conforming to the requirements in Federal Specification RR-F-191/1.

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: January 5, 2007

The fourth paragraph in Section 86-2.03, "Foundations," of the Standard Specifications is amended to read:

• After each post, standard, and pedestal on structures is in proper position, mortar shall be placed under the base plate as shown on the plans. The exposed portions shall be formed to present a neat appearance. Mortar shall conform to Section 51-1.135, "Mortar," except the mortar shall consist of one part by volume of cementitious material and 3 parts of clean sand and shall contain only sufficient moisture to permit packing. Mortar shall be cured by keeping it damp for 3 days.

Item D of the eighteenth paragraph in Section 86-2.05C, "Installation," of the Standard Specifications is amended to read:

D. The conduit shall be placed in the bottom of the trench, and the trench shall be backfilled with minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 590 pounds of cementitious material per cubic yard. Concrete backfill shall be placed to the pavement surface except, when the trench is in asphalt concrete pavement and additional pavement is not being placed, the top 0.10 foot of the trench shall be backfilled with asphalt concrete produced from commercial quality paving asphalt and aggregates.

Item C of the twenty-third paragraph in Section 86-2.05C, "Installation," of the Standard Specifications is amended to read:

C. Precast concrete conduit cradles shall conform to the dimensions shown on the plans and shall be constructed of minor concrete and commercial quality welded wire fabric. Minor concrete shall conform to the provisions in Section 90-10, "Minor Concrete," and shall contain not less than 590 pounds of cementitious material per cubic yard. The cradles shall be moist cured for not less than 3 days.

Item G of the twenty-third paragraph in Section 86-2.05C, "Installation," of the Standard Specifications is amended to read:

G. The space around conduits through bridge abutment walls shall be filled with mortar conforming to the provisions in Section 51-1.135, "Mortar," except that the proportion of cementitious material to sand shall be one to 3.

The fifth paragraph in Section 86-2.07, "Traffic Pull Boxes," of the Standard Specifications is amended to read:

• Concrete placed around and under traffic pull boxes as shown on the plans shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete."

The traffic signal controller cabinet requirement in the table in Section 86-2.08A, "Conductor Identification," of the Standard Specifications is amended to read:

Traffic Signal Controller Cabinet	Ungrounded Circuit Conductor	Blk	None	CON-1	6
	Grounded Circuit Conductor	Wht	None	CON-2	6

The first sentence of the first paragraph of Section 86-4.06, "Pedestrian Signal Faces," of the Standard Specifications is amended to read:

• Message symbols for pedestrian signal faces shall be white WALKING PERSON and Portland orange UPRAISED HAND conforming to the requirements in the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications" and the "California MUTCD."

The second sentence of the tenth paragraph of Section 86-4.07, "Light Emitting Diode Pedestrian Signal Face 'Upraised Hand' Module," of the Standard Specifications is amended to read:

• The color of "UPRAISED HAND" shall be Portland orange conforming to the requirements of the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications" and the "California MUTCD."

The first paragraph in Section 86-5.01D, "Removing or Abandoning Existing Pressure-Sensitive Detectors," of the Standard Specifications is amended to read:

• When a foundation for a pressure-sensitive vehicle detector is to be removed, the hole left by removing the detector frame and foundation shall be filled with minor concrete, except the roadway surface shall be reconstructed with material to match existing surfacing. Minor concrete shall conform to the provisions in Section 90-10, "Minor Concrete," except that the concrete shall contain not less than 420 pounds of cementitious material per cubic yard for asphalt concrete surfaced roadways and not less than 590 pounds of cementitious material per cubic yard for portland cement concrete surfaced roadways.

The first paragraph of Section 86-8.01, "Payment," of the Standard Specifications is amended to read:

• The contract lump sum price or prices paid for signal, ramp metering, flashing beacon, lighting, sign illumination, traffic monitoring station, highway advisory radio systems, closed circuit television systems, or combinations thereof; for modifying or removing those systems; for temporary systems; or the lump sum or unit prices paid for various units of those systems; or the lump sum or per foot price paid for conduit of the various sizes, types and installation methods listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and installing, modifying, or removing the systems, combinations or units thereof, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer, including any necessary pull boxes (except when the type required is shown as a separate contract item); excavation and backfill; concrete foundations (except when shown as a separate contract item); pedestrian barricades; furnishing and installing illuminated street name signs; installing sign panels on pedestrian barricades, on flashing beacon standards, and on traffic signal mast arms; restoring sidewalk, pavement and appurtenances damaged or destroyed during construction; salvaging existing materials; and making all required tests.

SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: January 5, 2007

Section 90, "Portland Cement Concrete," of the Standard Specifications is amended to read:

SECTION 90: PORTLAND CEMENT CONCRETE

90-1 GENERAL

90-1.01 DESCRIPTION

• Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.
• The Contractor shall determine the mix proportions for concrete in conformance with these specifications.
• Class 1 concrete shall contain not less than 675 pounds of cementitious material per cubic yard.
• Class 2 concrete shall contain not less than 590 pounds of cementitious material per cubic yard.
• Class 3 concrete shall contain not less than 505 pounds of cementitious material per cubic yard.
• Class 4 concrete shall contain not less than 420 pounds of cementitious material per cubic yard.
• Minor concrete shall contain not less than 550 pounds of cementitious material per cubic yard unless otherwise specified in these specifications or the special provisions.
• Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic yard of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content (Pounds/CY)
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min., 800 max.
Roof sections of exposed top box culverts	675 min., 800 max.
Other portions of structures	590 min., 800 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min.
Roof sections of exposed top box culverts	675 min.
Prestressed members	675 min.
Seal courses	675 min.
Other portions of structures	590 min.
Concrete for precast members	590 min., 925 max.

• Whenever the 28-day compressive strength shown on the plans is greater than 3,600 pounds per square inch, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 4,000 pounds per square inch or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 3,600 pounds per square inch or less are shown for design information only and are not a requirement for acceptance of the concrete.

• Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.

• Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.

• Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, supplementary cementitious material shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.

• If any concrete has a cementitious material, portland cement, or supplementary cementitious material content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.25 for each pound of cementitious material, portland cement, or supplementary cementitious material that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.

• The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENTITIOUS MATERIALS

• Unless otherwise specified, cementitious material shall be either a combination of Type II or Type V portland cement and a supplementary cementitious material, or a blended cement.

• Cementitious materials used in cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same sources and of the same proportions.

• Cementitious materials shall be protected from moisture until used. Sacked cementitious materials shall be piled to permit access for tallying, inspecting, and identifying each shipment.

• Facilities shall be provided to ensure that cementitious materials meeting this Section 90-2.01 are kept separate from other cementitious materials. Sampling cementitious materials shall be in conformance with California Test 125.

• The Contractor shall furnish a Certificate of Compliance for cementious materials in conformance with the provisions in Section 6-1.07, "Certificates of Compliance." The Certificate of Compliance shall indicate the source by name and location (including country, state, and city). If cementitious material is delivered directly to the job site, the Certificate of Compliance shall be signed by the cementitious material supplier. If the cementitious material is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-2.01A CEMENT

• Portland cement shall conform to the requirements in ASTM Designation: C 150 except, using a 10-sample moving average, limestone shall not exceed 2.5 percent. The C_3S content of Type II cement shall not exceed 65 percent.

• Blended cement shall conform to the requirements for Portland Blast-Furnace Slag, Cement Type IS (MS) or Portland-Pozzolan Cement, Type IP (MS) in AASHTO Designation: M 240 and shall be comprised of an intimate and uniform blend of Type II or Type V cement and supplementary cementitious material in an amount conforming to the requirements in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials."

• In addition, blended cement, Type II portland cement, and Type V portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60-percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by methods as required in AASHTO Designation: T 105;
B. The autoclave expansion shall not exceed 0.50-percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010-percent and shall not contract in air more than 0.048-percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053-percent.

• Type III portland cement shall be used only as specified in the special provisions or with the approval of the Engineer. Type III portland cement shall conform to the additional requirements listed above for Type II portland cement, except when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075-percent.

90-2.01B SUPPLEMENTARY CEMENTITIOUS MATERIALS (SCM)

• Fly ash shall conform to the requirements in AASHTO Designation: M 295, Class F, and the following:

A. Calcium oxide content shall not exceed 10 percent.
B. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
C. Commingling of fly ash from different sources at uncontrolled ratios is permissible only if the following criteria are satisfied:

    1. Sources of fly ash to be commingled shall be on the approved list of materials for use in concrete.
    2. Testing of the commingled product is the responsibility of the fly ash supplier.
    3. Each fly ash's running average of density shall not differ from any other by more than 0.01-pound per cubic inch at the time of commingling.
    4. Each fly ash's running average of loss on ignition shall not differ from any other by more than one percent at the time of commingling.
    5. The final product of commingled fly ash shall conform to the requirement in AASHTO Designation: M 295.

• Raw or calcined natural pozzolans shall conform to the requirements in AASHTO Designation: M 295, Class N and the following requirements:

A. Calcium oxide content shall not exceed 10 percent.
B. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.

• Ground Granulated Blast Furnace Slag (GGBFS) shall conform to the requirements in AASHTO Designation: M 302, Grade 100 or Grade 120.

• Silica Fume shall conform to the requirements of AASHTO Designation: M 307, with reduction in mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

90-2.01C REQUIRED USE OF SUPPLEMENTARY CEMENTITIOUS MATERIALS

• The amount of portland cement and SCM used in portland cement concrete shall conform to the minimum cementitious material content provisions in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and the following:

A. If a blended cement conforming to the provisions in Section 90-2.01A, "Cement," is used, the minimum amount of SCM incorporated into the cement shall conform to the provisions in this Section 90-2.01C.
B. Fly ash or natural pozzolan, silica fume, or GGBFS shall not be used with Type IP or Type IS cements.

- Use of SCMs shall conform to the following:

A. If fly ash or natural pozzolan is used:

1. The minimum amount of portland cement shall not be less than 75 percent by weight of the specified minimum cementitious material content.
2. The minimum amount of fly ash or natural pozzolan shall be:

    a. Fifteen percent by weight of the total amount of cementitious material if the calcium oxide content of fly ash or natural pozzolan is equal to or less than 2 percent by weight;
    b. Twenty-five percent by weight of the total amount of cementitious material if the calcium oxide content of fly ash or natural pozzolan is greater than 2 percent by weight.

3. The total amount of fly ash or natural pozzolan shall not exceed 35 percent by weight of the total amount of cementitious material to be used in the mix. If Section 90-1.01, "Description," specifies a maximum cementitious material content in pounds per cubic yard, the total weight of portland cement and fly ash or natural pozzolan per cubic yard shall not exceed the specified maximum cementitious material content.

B. If silica fume is used:

1. The amount of silica fume shall not be less than 10 percent by weight of the total amount of cementitious material.
2. The amount of portland cement shall not be less than 75 percent by weight of the specified minimum cementitious material content.
3. If Section 90-1.01, "Description," specifies a maximum cementitious material content in pounds per cubic yard, the total weight of portland cement and silica fume per cubic yard shall not exceed the specified maximum cementitious material content.

C. If GGBFS is used:

1. The minimum amount of GGBFS shall be either:

    a. Forty percent of the total cementitious material to be used, if the aggregates used in the concrete are on the Department's list of "Approved Aggregates For Use in Concrete with Reduced Fly Ash."
    b. No less than 50 percent.

2. The amount of GGBFS shall not exceed 60 percent by weight of the total amount of cementitious materials to be used.

90-2.02 AGGREGATES

- Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.
- The Contractor shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.
- Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."
- Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60 or greater when tested for durability in conformance with California Test 229.
- If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."

• If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

• If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.

• The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs are in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."

• No single Cleanness Value, Sand Equivalent, or aggregate grading test shall represent more than 300 cubic yards of concrete or one day's pour, whichever is smaller.

• When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

90-2.02A COARSE AGGREGATE

• Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, reclaimed aggregate, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.

• Reclaimed aggregate is aggregate that has been recovered from plastic concrete by washing away the cementitious material. Reclaimed aggregate shall conform to all aggregate requirements.

• Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

• In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested in conformance with the requirements in California Test 227; and
B. Prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B FINE AGGREGATE

• Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.

• Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory[a]
Mortar Strengths Relative to Ottawa Sand	515	95%, min.
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

• In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71, minimum, and a Sand Equivalent "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
B. Prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

• In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

• In nonreinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1,500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.

• In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

• Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O + 0.658\ K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

• Admixture materials shall conform to the requirements in the following ASTM Designations:

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

• Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation

shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

• The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and 90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

• Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
1 1/2" x 3/4"	1"	19 - 41
1" x No. 4	3/4"	52 - 85
1" x No. 4	3/8"	15 - 38
1/2" x No. 4	3/8"	40 - 78
3/8" x No. 8	3/8"	50 - 85
Fine Aggregate	No. 16	55 - 75
Fine Aggregate	No. 30	34 - 46
Fine Aggregate	No. 50	16 - 29

• Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

• The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

	Percentage Passing Primary Aggregate Nominal Sizes							
	1 1/2" x 3/4"		1" x No. 4		1/2" x No. 4		3/8" x No. 8	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	—	—	—	—	—	—
1 1/2"	88 - 100	85 - 100	100	100	—	—	—	—
1"	X ±18	X ±25	88 - 100	86 - 100	—	—	—	—
3/4"	0 - 17	0 - 20	X ±15	X ±22	100	100	—	—
1/2"	—	—	—	—	82 - 100	80 - 100	100	100
3/8"	0 - 7	0 - 9	X ±15	X ±22	X ±15	X ±22	X ±15	X ±20
No. 4	—	—	0 - 16	0 - 18	0 - 15	0 - 18	0 - 25	0 - 28
No. 8	—	—	0 - 6	0 - 7	0 - 6	0 - 7	0 - 6	0 - 7

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• Coarse aggregate for the 1 1/2 inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

• When the one inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 1" x No. 4 primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

• Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
3/8"	100	100
No. 4	95 - 100	93 - 100
No. 8	65 - 95	61 - 99
No. 16	X ±10	X ±13
No. 30	X ±9	X ±12
No. 50	X ±6	X ±9
No. 100	2 - 12	1 - 15
No. 200	0 - 8	0 - 10

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40, and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

• Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

• Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein.

• The combined aggregate grading, except when otherwise specified in these specifications or the special provisions, shall be either the 1 1/2 inch, maximum grading, or the 1 inch, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	1 1/2" Max.	1" Max.	1/2" Max.	3/8" Max.
2"	100	—	—	—
1 1/2"	90 - 100	100	—	—
1"	50 - 86	90 - 100	—	—
3/4"	45 - 75	55 - 100	100	—
1/2"	—	—	90 - 100	100
3/8"	38 - 55	45 - 75	55 - 86	50 - 100
No. 4	30 - 45	35 - 60	45 - 63	45 - 63
No. 8	23 - 38	27 - 45	35 - 49	35 - 49
No. 16	17 - 33	20 - 35	25 - 37	25 - 37
No. 30	10 - 22	12 - 25	15 - 25	15 - 25
No. 50	4 - 10	5 - 15	5 - 15	5 - 15
No. 100	1 - 6	1 - 8	1 - 8	1 - 8
No. 200	0 - 3	0 - 4	0 - 4	0 - 4

• Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

• Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

• Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined by California Test 415, shall not be used.

• Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

• If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

• Chemical admixtures shall be used in conformance with the manufacturer's written recommendations.

90-4.02 MATERIALS

• Admixture materials shall conform to the provisions in Section 90–2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

• No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.

• Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.

• If the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES

• If the use of a chemical admixture is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

• The Contractor may use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

A. If a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by weight, except that the resultant cementitious material content shall be not less than 505 pounds per cubic yard; and
B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

• Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate.

90-4.08 BLANK

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

• Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

• Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

• If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix, unless it is demonstrated that a different sequence improves performance.

• When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

• Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

• Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

90-4.11 BLANK

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

• Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and the various sizes shall not become intermixed before proportioning.

• Aggregates shall be stored or stockpiled and handled in a manner that prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

• In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

• Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and supplementary cementitious material for one batch of concrete is a single operation of a switch or starter.

• Proportioning devices shall be tested as frequently as the Engineer may deem necessary to ensure their accuracy.

• Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the weight of each batch of material shall not vary from the weight designated by the Engineer by more than the tolerances specified herein.

• Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ±0.5 percent of the individual batch weight designated for each size of aggregate. Equipment for cumulative weighing of cement and supplementary cementitious material shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the cement and supplementary cementitious material. Equipment for weighing cement or supplementary cementitious material separately shall have a zero tolerance of ±0.5 percent of their designated individual batch weights. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated weight or volume.

• The weight indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch weight of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch weights; and
B. Cement shall be 99 to 102 percent of its designated batch weight. When weighed individually, supplementary cementitious material shall be 99 to 102 percent of its designated batch weight. When supplementary cementitious material and cement are permitted to be weighed cumulatively, cement shall be weighed first to 99 to 102 percent of its designated batch weight, and the total for cement and supplementary cementitious material shall be 99 to 102 percent of the sum of their designated batch weights; and
C. Water shall be within 1.5 percent of its designated weight or volume.

• Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, supplementary cementitious material, or cement plus supplementary cementitious material and aggregates shall not exceed that of commercially available scales having single graduations indicating a weight not exceeding the maximum permissible weight variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one pound graduations.

90-5.03 PROPORTIONING

• Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cementitious material and water as provided in these specifications. Aggregates shall be proportioned by weight.

• At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry weight.

• Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

• Bulk Type IP (MS) cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

• Bulk cement and supplementary cementitious material may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and supplementary cementitious material are weighed cumulatively, the cement shall be weighed first.

• If cement and supplementary cementitious material are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the supplementary cementitious material shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material-weighing device. The cement and the supplementary cementitious material shall be discharged into the mixer simultaneously with the aggregate.

- The scales and weigh hoppers for bulk weighing cement, supplementary cementitious material, or cement plus supplementary cementitious material shall be separate and distinct from the aggregate weighing equipment.
- For batches of one cubic yard or more, the batching equipment shall conform to one of the following combinations:

A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
B. Single box and scale indicator for all aggregates.
C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

- In order to check the accuracy of batch weights, the gross weight and tare weight of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined when ordered by the Engineer. The equipment shall be weighed on scales designated by the Engineer.

90-5.03A PROPORTIONING FOR PAVEMENT

- Aggregates and bulk supplementary cementitious material for use in pavement shall be proportioned by weight by means of automatic proportioning devices of approved type conforming to these specifications.
- The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by weight of the fine aggregate.
- The batching of cement, supplementary cementitious material, or cement plus supplementary cementitious material and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and supplementary cementitious material hoppers or the cement plus supplementary cementitious material hopper are charged with weights that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- If interlocks are required for cement and supplementary cementitious material charging mechanisms and cement and supplementary cementitious material are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the weight of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- If concrete is completely mixed in stationary paving mixers, the supplementary cementitious materials shall be weighed in a separate weigh hopper and the supplementary cementitious material and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the Contractor provides certification that the stationary mixer is capable of mixing the cement, supplementary cementitious material, aggregates, and water uniformly before discharge, weighing the supplementary cementitious material cumulatively with the cement is permitted. Certification shall contain the following:

A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength";
B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
C. The mixer rotation speed and time of mixing before discharge that are required to produce a mix that meets the requirements above.

- The discharge gate on the cement and supplementary cementitious material hoppers or the cement plus supplementary cementitious material hopper shall be designed to permit regulating the flow of cement, supplementary cementitious material, or cement plus supplementary cementitious material into the aggregate as directed by the Engineer.
- If separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
- Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
- If the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.

• The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

• Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."

• Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.

• Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cementitious material.

• Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.

• When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2-inch. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 170 pounds per cubic yard of concrete.

Average Slump	Maximum Permissible Difference
Less than 4"	1"
4" to 6"	1 1/2"
Greater than 6" to 9"	2"

• The Contractor shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

• Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

• The temperature of mixed concrete, immediately before placing, shall be not less than 50° F or more than 90° F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150° F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

• The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time.

• Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

• Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

• The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

• The size of batch shall not exceed the manufacturer's guaranteed capacity.

• When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at job site batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

• Concrete shall be mixed and delivered to the job site by means of one of the following combinations of operations:

A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in nonagitating hauling equipment (central-mixed concrete).
B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
C. Mixed completely in a truck mixer (transit-mixed concrete).
D. Mixed completely in a paving mixer.

• Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

• Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

• When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete shall apply. No credit in the number of revolutions at mixing speed will be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

• Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."

• Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.

• Bodies of nonagitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.

• Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75° F.

• No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.

• The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

• If a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or if the temperature of the concrete is 85° F or above, the time allowed may be less than 1.5 hours. If an admixture is used to retard the set time, the temperature of the concrete shall not exceed 85° F, the time limit shall be 2 hours, and the revolution limitation shall be 300.

• If nonagitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

• Each load of concrete delivered at the job site shall be accompanied by a weighmaster certificate showing the mix identification number, nonrepeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale weights (pounds) for the ingredients batched. Theoretical or target batch weights shall not be used as a substitute for actual scale weights.

• Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 3 1/2-inch diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return" (LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

• The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch weights or measurements for a load of concrete provided that both certificates are imprinted with the same nonrepeating load number that is unique to the contract and delivered to the jobsite with the load.

• Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

• Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

• The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

• The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

• The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

• When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

90-6.05 HAND-MIXING

• Hand-mixed concrete shall be made in batches of not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cementitious materials and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

• The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the nominal values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. If Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 9 inches after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (inches)	Slump (inches)	Penetration (inches)	Slump (inches)
Concrete Pavement	0 - 1	—	1 1/2	—
Non-reinforced concrete facilities	0 - 1 1/2	—	2	—
Reinforced concrete structures				
Sections over 12 inches thick	0 - 1 1/2	—	2 1/2	—
Sections 12 inches thick or less	0 - 2	—	3	—
Concrete placed under water	—	6 - 8	—	9
Cast-in-place concrete piles	2 1/2 - 3 1/2	5 - 7	4	8

• The amount of free water used in concrete shall not exceed 310 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 550 pounds per cubic yard.

• The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

• If there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard. Full compensation for additional cementitious material and water added under these conditions shall be considered as included in the contract price paid for the concrete work involved and no additional compensation will be allowed therefor.

• The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

• Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A WATER METHOD

• The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

• Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period.

• If a curing medium consisting of cotton mats, rugs, carpets, polyethylene sheeting, polyethylene sheeting on burlap, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing media.

• At the option of the Contractor, a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap may be used to cure concrete structures. The polyethylene sheeting shall have a minimum thickness of 4-mil, and shall be extruded onto 10-ounce burlap.

• At the option of the Contractor, a curing medium consisting of polyethylene sheeting may be used to cure concrete columns. The polyethylene sheeting shall have a minimum thickness of 10-mil achieved in a single layer of material.

• If the Contractor chooses to use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium, these media and any joints therein shall be secured as necessary to provide moisture retention and shall be within 3 inches of the concrete at all points along the surface being cured. When these media are used, the temperature of the concrete shall be monitored during curing. If the temperature of the concrete cannot be maintained below 140° F, use of these curing media shall be disallowed.

• When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified above, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B CURING COMPOUND METHOD

• Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

• Curing compounds to be used shall be as follows:

1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
4. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
5. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
6. Nonpigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

• The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.

• The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.28-pounds per square yard in 24 hours.

• The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.

- If the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
- Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.
- At any point, the application rate shall be within ±50 square feet per gallon of the nominal rate specified, and the average application rate shall be within ±25 square feet per gallon of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
- Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
- The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.
- At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
- Agitation shall not introduce air or other foreign substance into the curing compound.
- The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
- Curing compounds shall remain sprayable at temperatures above 40° F and shall not be diluted or altered after manufacture.
- The curing compound shall be packaged in clean 274-gallon totes, 55-gallon barrels or 5-gallon pails shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 274-gallon totes and the 55-gallon barrels shall have removable lids and airtight fasteners. The 5-gallon pails shall be round and have standard full open head and bail. Lids with bungholes will not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with these specifications and the manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.
- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.
- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State.
- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State.
- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.
- Curing compound will be sampled by the Engineer at the source of supply, at the job site, or at both locations.
- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.

• Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C WATERPROOF MEMBRANE METHOD

• The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane, shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

• Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.

• The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33-foot.

• The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.

• Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.

• Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D FORMS-IN-PLACE METHOD

• Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

• Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

• The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

• Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."

• When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 60° F, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

• Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

• The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only ordinary surface finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

• The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

• Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

• When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

• Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50° F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50° F and 90° F.
B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 40° F per hour. The curing temperature throughout the enclosure shall not exceed 150° F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.
F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 60° F until the stress is transferred to the concrete.
G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

• Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles in a corrosive environment shall be cured as follows:

A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

• Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

• Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."

• Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."

• Shotcrete shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

• Mortar and grout shall be cured by keeping the surface damp for 3 days.

• After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

• In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8. If required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.

• The Contractor shall protect concrete from damage from any cause, which shall include, but not be limited to: rain, heat, cold, wind, Contractor's actions, and actions of others.

• Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

• Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.

• Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

• Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45° F for 72 hours after placing and at not less than 40° F for an additional 4 days.

90-8.03 PROTECTING CONCRETE PAVEMENT

• Pavement concrete shall be maintained at a temperature of not less than 40° F for 72 hours.

• Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.

• If ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work.". Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 550 pounds per square inch. The modulus of rupture will be determined by California Test 523.

• No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 550 pounds per square inch. Concrete that fails to attain a modulus of rupture of 550 pounds per square inch within 10 days shall not be opened to traffic until directed by the Engineer.

• Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."

• When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 350 pounds per square inch has been attained, provided that:

A. Unit pressure exerted on the pavement by the paver shall not exceed 20 pounds per square inch;
B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
C. No part of the track shall be closer than one foot from the edge of pavement.

• In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.

• Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor.

• The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

• Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.

• The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.

• When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.

• When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $10 for each in-place cubic yard of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State $15 for each in-place cubic yard of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

• If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.

• No single compressive strength test shall represent more than 320 cubic yards.

• If a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. If the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.

• When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.

• Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.

• Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 580 pounds per square inch greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.

• Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

• The certified test data and trial batch test reports shall include the following information:

A. Date of mixing.
B. Mixing equipment and procedures used.
C. The size of batch in cubic yards and the weight, type, and source of all ingredients used.
D. Penetration or slump (if the concrete will be placed under water or placed in cast-in-place concrete piles) of the concrete.
E. The air content of the concrete if an air-entraining admixture is used.
F. The age at time of testing and strength of all concrete cylinders tested.

• Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.

• When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.

• After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.

• The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.

• When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

• Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.

• The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

• Minor concrete shall conform to the following requirements:

90-10.02A CEMENTITIOUS MATERIAL

• Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

90-10.02B AGGREGATE

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.
- Use of crushed concrete or reclaimed aggregate is acceptable only if the aggregate satisfies all aggregate requirements.
- The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.
- The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1 1/2-inch or smaller than 3/4-inch.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C WATER

- Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D ADMIXTURES

- The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.
- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."
- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 90° F will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.
- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.
- When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.
- Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.
- A Certificate of Compliance conforming to the provisions in Section 6–1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

- Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

- Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40° F for 72 hours after placing.

90-10.06 MEASUREMENT AND PAYMENT

• Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

• Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

• For concrete measured at the mixer, the volume in cubic feet shall be computed as the total weight of the batch in pounds divided by the density of the concrete in pounds per cubic foot. The total weight of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

• Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

• Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.

• Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

• Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

SECTION 91: PAINT

Issue Date: May 1, 2006

Section 91-3, "Paints for Timber," of the Standard Specifications is amended to read:

91-3 PAINTS FOR TIMBER

91-3.01 WOOD PRIMER, LATEX-BASE

Classification:

• This specification covers a ready-mixed priming paint for use on unpainted wood or exterior woodwork. It shall conform with the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for exterior wood primers, and be listed on the Exterior Latex Wood Primer MPI List Number 6.

91-3.02 PAINT; LATEX-BASE FOR EXTERIOR WOOD, WHITE AND TINTS

Classification:

• This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products List:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

• Unpainted wood shall first be primed with wood primer conforming to the provisions in Section 91-3.01, "Wood Primer, Latex-Base."

Section 91-4, "Miscellaneous Paints," of the Standard Specifications is amended to read:

91-4 MISCELLANEOUS PAINTS

91-4.01 THROUGH 91-4.04 (BLANK)

91-4.05 PAINT; ACRYLIC EMULSION, EXTERIOR WHITE AND LIGHT AND MEDIUM TINTS

Classification:

• This specification covers an acrylic emulsion paint designed for use on exterior masonry. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products Lists:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

• This paint may be tinted by using "universal" or "all purpose" concentrates.

SECTION 92: ASPHALTS

Issue Date: February 2, 2007

Section 92, "Asphalts," of the Standard Specifications is amended to read:

92-1.01 DESCRIPTION

• Asphalt is refined petroleum or a mixture of refined liquid asphalt and refined solid asphalt that are prepared from crude petroleum. Asphalt is:

1. Free from residues caused by the artificial distillation of coal, coal tar, or paraffin
2. Free from water
3. Homogeneous

92-1.02 MATERIALS

GENERAL

• Furnish asphalt under the Department's "Certification Program for Suppliers of Asphalt." The Department maintains the program requirements, procedures, and a list of approved suppliers at:

http://www.dot.ca.gov/hq/esc/Translab/fpmcoc.htm

• Transport, store, use, and dispose of asphalt safely.
• Prevent the formation of carbonized particles caused by overheating asphalt during manufacturing or construction.

GRADES

• Performance graded (PG) asphalt binder is:

Performance Graded Asphalt Binder

Property	AASHTO Test Method	Specification Grade PG 58-22 [a]	PG 64-10	PG 64-16	PG 64-28	PG 70-10
Original Binder						
Flash Point, Minimum °C	T 48	230	230	230	230	230
Solubility, Minimum % [b]	T 44	99	99	99	99	99
Viscosity at 135°C, [c] Maximum, Pa·s	T 316	3.0	3.0	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C	T 315	58	64	64	64	70
Minimum G*/sin(delta), kPa		1.00	1.00	1.00	1.00	1.00
RTFO Test, [e] Mass Loss, Maximum, %	T 240	1.00	1.00	1.00	1.00	1.00
RTFO Test Aged Binder						
Dynamic Shear, Test Temp. at 10 rad/s, °C	T 315	58	64	64	64	70
Minimum G*/sin(delta), kPa		2.20	2.20	2.20	2.20	2.20
Ductility at 25°C Minimum, cm	T 51	75	75	75	75	75
PAV [f] Aging, Temperature, °C	R 28	100	100	100	100	110
RTFO Test and PAV Aged Binder						
Dynamic Shear, Test Temp. at 10 rad/s, °C	T 315	22 [d]	31 [d]	28 [d]	22 [d]	34 [d]
Maximum G*sin(delta), kPa		5000	5000	5000	5000	5000
Creep Stiffness, Test Temperature, °C	T 313	-12	0	-6	-18	0
Maximum S-value, Mpa		300	300	300	300	300
Minimum M-value		0.300	0.300	0.300	0.300	0.300

Notes:

a. Use as asphalt rubber base stock for high mountain and high desert area.

b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."

c. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.

d. Test the sample at 3°C higher if it fails at the specified test temperature. G*sin(delta) remains 5000 kPa maximum.

e. "RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM Designation: D 2872. The residue from mass change determination may be used for other tests.

f. "PAV" means Pressurized Aging Vessel.

- Performance graded polymer modified asphalt binder (PG Polymer Modified) is:

Performance Graded Polymer Modified Asphalt Binder [a]

Property	AASHTO Test Method	Specification Grade		
		PG 58-34 PM	PG 64-28 PM	PG 76-22 PM
Original Binder				
Flash Point, Minimum °C	T 48	230	230	230
Solubility, Minimum % [b]	T 44[c]	98.5	98.5	98.5
Viscosity at 135°C, [d] Maximum, Pa·s	T 316	3.0	3.0	3.0
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 1.00	64 1.00	76 1.00
RTFO Test , Mass Loss, Maximum, %	T 240	1.00	1.00	1.00
RTFO Test Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Minimum G*/sin(delta), kPa	T 315	58 2.20	64 2.20	76 2.20
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum (delta), %	T 315	Note e 80	Note e 80	Note e 80
Elastic Recovery[f], Test Temp., °C Minimum recovery, %	T 301	25 75	25 75	25 65
PAV[g] Aging, Temperature, °C	R 28	100	100	110
RTFO Test and PAV Aged Binder				
Dynamic Shear, Test Temp. at 10 rad/s, °C Maximum G*sin(delta), kPa	T 315	16 5000	22 5000	31 5000
Creep Stiffness, Test Temperature, °C Maximum S-value, MPa Minimum M-value	T 313	-24 300 0.300	-18 300 0.300	-12 300 0.300

Notes:

a. Do not modify PG Polymer Modified using acid modification.

b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."

c. The Department allows ASTM D 5546 instead of AASHTO T 44

d. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.

e. Test temperature is the temperature at which G*/sin(delta) is 2.2 kPa. A graph of log G*/sin(delta) plotted against temperature may be used to determine the test temperature when G*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G*/sin(delta) is 2.2 kPa.

f. Tests without a force ductility clamp may be performed.

g. "PAV" means Pressurized Aging Vessel.

SAMPLING

- Provide a sampling device in the asphalt feed line connecting the plant storage tanks to the asphalt weighing system or spray bar. Make the sampling device accessible between 24 and 30 inches above the platform. Provide a receptacle for flushing the sampling device.
- Include with the sampling device a valve:

1. Between 1/2 and 3/4 inch in diameter
2. Manufactured in a manner that a one-quart sample may be taken slowly at any time during plant operations
3. Maintained in good condition

- Replace failed valves.
- In the Engineer's presence, take 2 one-quart samples per operating day. Provide round, friction top, one-quart containers for storing samples.

92-1.03 EXECUTION

- If asphalt is applied, you must comply with the heating and application specifications for liquid asphalt in Section 93, "Liquid Asphalts."

92-1.04 MEASUREMENT

- If the contract work item for asphalt is paid by weight, the Department measures asphalt tons by complying with the specifications for weight determination of liquid asphalt in Section 93, "Liquid Asphalts."
- The Engineer determines the asphalt weight from volumetric measurements if you:

1. Use a partial asphalt load
2. Use asphalt at a location other than a mixing plant and no scales within 20 miles are available and suitable
3. Deliver asphalt in either of the following:

    3.1. A calibrated truck with each tank accompanied by its measuring stick and calibration card
    3.2. A truck equipped with a calibrated thermometer that determines the asphalt temperature at the delivery time and with a vehicle tank meter complying with the specifications for weighing, measuring, and metering devices in Section 9-1.01, "Measurement of Quantities"

- If you furnish asphalt concrete from a mixing plant producing material for only one project, the Engineer determines the asphalt quantity by measuring the volume in the tank at the project's start and end provided the tank is calibrated and equipped with its measuring stick and calibration card.
- The Engineer determines pay quantities from volumetric measurements as follows:

1. Before converting the volume to weight, the Engineer reduces the measured volume to that which the asphalt would occupy at 60 °F.
2. The Engineer uses 235 gallons per ton and 8.51 pounds per gallon for the average weight and volume for PG and PG Polymer Modified asphalt grades at 60 °F.
3. The Engineer uses the Conversion Table in Section 93, "Liquid Asphalts."

SECTION 93: LIQUID ASPHALTS

Issue Date: November 3, 2006

The ninth paragraph of Section 93-1.04, "Measurement," of the Standard Specifications is amended to read:

- The following Legend and Conversion Table is to be used for converting volumes of liquid asphalt products, Grades 70 to 3000, inclusive, and paving asphalt Grades PG 58-22, PG 64-10, PG 64-16, PG 64-28, and PG 70-10, and Grades PG 58-34 PM, PG 64-28 PM, and PG 76-22 PM.

END OF AMENDMENTS

SECTION 2. PROPOSAL REQUIREMENTS AND CONDITIONS

2-1.01 GENERAL

The bidder's attention is directed to the provisions in Section 2, "Proposal Requirements and Conditions," of the Standard Specifications and these special provisions for the requirements and conditions which the bidder must observe in the preparation of the proposal form and the submission of the bid.

The bidder shall complete the "List of Subcontractors" form in the Proposal and Contract book, listing the name, address, and portion of work to be performed by each subcontractor listed. In addition to the subcontractors required to be listed in conformance with Section 2-1.054, "Required Listing of Proposed Subcontractors," of the Standard Specifications, the bidder shall list on this form each first tier Disabled Veteran Business Enterprise subcontractor to be used for credit in meeting the goal. A first tier subcontractor is one to whom the bidder proposes to directly subcontract portions of the work.

The Bidder's Bond form mentioned in the last paragraph in Section 2-1.07, "Proposal Guaranty," of the Standard Specifications will be found following the signature page of the Proposal.

Submit request for substitution of an "or equal" item, and the data substantiating the request to the Department of Transportation, District 8 Construction, MS 1104, 464 West 4th Street, 6th Floor, San Bernardino, CA 92401-1400, so that the request is received by the Department by close of business on the fourth business day following bid opening.

In conformance with Public Contract Code Section 7106, a Noncollusion Affidavit is included in the Proposal. Signing the Proposal shall also constitute signature of the Noncollusion Affidavit.

Failure of the bidder to fulfill the requirements of the Special Provisions for submittals required to be furnished after bid opening, (including but not limited to DVBE submittals, and escrowed bid documents or prequalification materials when required), may subject the bidder to a determination of the bidder's responsibility in the event it is the apparent low bidder on any subsequent public works contracts.

2-1.02 DISABLED VETERAN BUSINESS ENTERPRISE (DVBE)

It is the policy of the Department that Disabled Veteran Business Enterprises (DVBEs) shall be provided the opportunity for full participation in the performance of contracts financed solely with state funds. The Contractor shall take all necessary and reasonable steps to ensure that DVBEs have such opportunity to participate in the performance of this contract. The Contractor shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of subcontracts.

It is the bidder's responsibility to make a sufficient portion of the work available to subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DVBE subcontractors and suppliers, so as to assure meeting the goal for DVBE participation or to provide information to establish that, prior to bidding, the bidder made good faith efforts to do so.

Section 999, et seq., of the Military and Veterans Code sets forth requirements for DVBE participation goals, summarized as follows:

A. "Disabled Veteran Business Enterprise" (DVBE) means a business concern certified as a DVBE by the Office of Small Business and DVBE Services, Department of General Services.
B. DVBEs must be certified on the date bids for the project are opened before credit may be allowed toward the DVBE goal. It is the Contractor's responsibility to verify that DVBEs are certified.
C. The disabled veteran business owner must be domiciled in the State of California.
D. A DVBE may participate as a prime contractor, as a subcontractor, as a joint venture partner with a prime or subcontractor, or as a vendor of material or supplies.
E. The DVBE must perform a commercially useful function, that is, be responsible for the execution of a distinct element of the work and carry out its responsibility by actually performing, managing, or supervising the work. An extra participant will not be considered to perform a commercially useful function.
F. Credit for DVBE prime contractors will be 100 percent of the contract price.
G. Credit for participation of a DVBE subcontractor, supplier, or broker will be 100 percent provided such DVBE is performing a commercially useful function.
H. A DVBE broker shall submit the required declarations and federal tax returns at the time of performance.

Failure to carry out the requirements of Section 999, et seq., of the Military and Veterans Code shall constitute a material breach of this contract and may result in termination of the contract or other remedy the Department deems appropriate.

A DVBE joint venture partner must be responsible for specific contract items of work, or portions thereof. The DVBE joint venture partner must share in the ownership, control, management responsibilities, risks, and profits of the joint venture. The DVBE joint venture must submit the joint venture agreement with the Caltrans Bidder DVBE Information form required in Section 2-1.02B, "Submission of DVBE Information," elsewhere in these special provisions.

Section 10115 of the Public Contract Code requires the Department to establish a goal for Disabled Veteran Business Enterprise (DVBE) participation in contracts.

2-1.02A DVBE GOAL FOR THIS PROJECT

The Disabled Veteran Business Enterprise (DVBE) participation goal for this project: 3 percent.

The Office of Small Business and DVBE Services, Department of General Services, is located at 707 Third Street, West Sacramento, CA 95605. It may be contacted at (800) 559-5529 or (916) 375-4940 or its internet web site at http://www.pd.dgs.ca.gov/smbus/default.htm for program information.

2-1.02B SUBMISSION OF DVBE INFORMATION

The required DVBE information shall be submitted on the "CALTRANS BIDDER - DVBE INFORMATION" form included in the Proposal. If this information is not submitted with the bid, the DVBE information forms shall be removed from the documents prior to submitting the bid.

If the DVBE information is not submitted with the bid, the apparent successful bidder (low bidder), the second low bidder and the third low bidder shall submit the DVBE information to the following address: Department of Transportation, MS 43, Attn: Office Engineer, 1727 30th Street, Sacramento, California 95816 so the information is received by the Department no later than 4:00 p.m. on the fourth business day following bid opening. The Department will not accept facsimile submittals of DVBE information. Failure to submit the required DVBE information by the time specified will be grounds for finding the bid or proposal nonresponsive. Other bidders need not submit DVBE information unless requested to do so by the Department.

The bidder's DVBE information shall establish that either it met the goal or that, prior to bidding, it made good faith efforts to meet the goal. Information demonstrating that a good faith effort to meet the DVBE goal has been made by the bidder shall be submitted on the "DVBE INFORMATION GOOD FAITH EFFORTS" form included in the Proposal.

Bidders are cautioned that even though their submittal indicates they will meet the stated DVBE goal, their submittal should also include their good faith efforts information along with their DVBE goal information to protect their eligibility for award of the contract in the event the Department, in its review, finds that the goal has not been met.

The bidder's DVBE information shall include the names of all DVBE firms that will participate, with a complete description of work or supplies to be provided by each and the dollar value of each DVBE transaction. When 100 percent of a contract item of work is not to be performed or furnished by a DVBE, a description of the exact portion of that work to be performed or furnished by that DVBE shall be included in the DVBE information, including the planned location of that work.

A bidder shall be deemed to have made good faith efforts if, within the time specified by the Department, it submits documentary evidence that all of the following actions were taken:

A. Contact was made with the Office of Small Business and DVBE Services, Department of General Services or their web site at http://www.pd.dgs.ca.gov/smbus/default.htm to identify Disabled Veteran Business Enterprises.
B. Advertising was published in trade media and media focusing on Disabled Veteran Business Enterprises, unless time limits imposed by the Department do not permit that advertising.
C. Invitations to bid were submitted to potential Disabled Veteran Business Enterprise contractors.
D. Available Disabled Veteran Business Enterprises were considered.

2-1.03 SMALL BUSINESS AND NON-SMALL BUSINESS SUBCONTRACTOR PREFERENCES

Attention is directed to the Small Business Procurement and Contract Act, Government Code Section 14835, et seq. and to the Small Business regulations at Title 2, California Code of Regulations, Section 1896, et seq.

Bidders, subcontractors, and suppliers who wish to be certified as Small Businesses under the provisions of those laws and regulations, shall be certified as Small Business by the Office of Small Business and DVBE Services, Department of General Services, 707 Third Street, West Sacramento, CA 95605.

Attention is directed to "Award and Execution of Contract" of these special provisions.

2-1.03A SMALL BUSINESS PREFERENCE

To request Small Business Preference, bidders shall fill out and sign the "Request for Small Business Preference and Non-Small Business Subcontractor Preference" form in the Proposal and shall attach a copy of their Office of Small Business and DVBE Services Small Business Certification letter to the form. The bidder's signature on the "Request for Small Business Preference" certifies that the bidder is certified as a Small Business at the time and day of bid opening or has applied for certification and is subsequently certified by the Department of General Services.

2-1.03B NON-SMALL BUSINESS SUBCONTRACTOR PREFERENCE

To request Non-Small Business Subcontractor Preference, bidders shall fill out and sign the "Request for Small Business Preference and Non-Small Business Subcontractor Preference" form in the Proposal. The bidder's signature certifies that the bidder commits to subcontract at least 25 percent of its bid amount with one or more subcontractors or suppliers that are certified as Small Businesses.

The bidder shall also fill out the "CALTRANS BIDDER – SMALL BUSINESS SUBCONTRACTOR - INFORMATION" form. If the Small Business Subcontractor information is not submitted with the bid, the form shall be removed from the documents and submitted in the same time and manner specified for DVBE Information in "Submission of DVBE Information" of these special provisions. The bidder shall attach a copy of the Office of Small Business and DVBE Services small business certification letter for each listed subcontractor or supplier, to the form. The listed subcontractors and suppliers shall be certified as Small Business at the time and day of bid opening or have applied for certification and are subsequently certified by the Department of General Services. Each listed subcontractor or supplier shall be designated to perform a commercially useful function.

2-1.04 CALIFORNIA COMPANY PREFERENCE

Attention is directed to "Award and Execution of Contract" of these special provisions.

In conformance with the requirements of Section 6107 of the Public Contract Code, a "California company" will be granted a reciprocal preference for bid comparison purposes as against a nonresident contractor from any state that gives or requires a preference to be given contractors from that state on its public entity construction contracts.

A "California company" means a sole proprietorship, partnership, joint venture, corporation, or other business entity that was a licensed California contractor on the date when bids for the public contract were opened and meets one of the following:

A. Has its principal place of business in California.
B. Has its principal place of business in a state in which there is no local contractor preference on construction contracts.
C. Has its principal place of business in a state in which there is a local contractor construction preference and the Contractor has paid not less than $5000 in sales or use taxes to California for construction related activity for each of the five years immediately preceding the submission of the bid.

To carry out the "California company" reciprocal preference requirements of Section 6107 of the Public Contract Code, all bidders shall fill out and sign the California Company Preference form in the Proposal. The bidder's signature on the California Company Preference form certifies, under penalty of perjury, that the bidder is or is not a "California company" and if not, the amount of the preference applied by the state of the nonresident Contractor.

A nonresident Contractor shall disclose any and all bid preferences provided to the nonresident Contractor by the state or country in which the nonresident Contractor has its principal place of business.

Proposals without the California Company Preference form filled out and signed may be rejected.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

The bidder's attention is directed to the provisions in Section 3, "Award and Execution of Contract," of the Standard Specifications and these special provisions for the requirements and conditions concerning award and execution of contract.

Requests for relief of bid and bid protests are to be delivered to the following address: Department of Transportation, MS 43, Attn: Office Engineer, 1727 30th Street, Sacramento, CA 95816 or by facsimile to the Office Engineer at (916) 227-6282.

The award of the contract, if made, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed and who has met the goal for DVBE participation or has demonstrated, to the satisfaction of the Department, good faith efforts to do so.

The contract shall be executed by the successful bidder and shall be returned, together with the contract bonds and the documents identified in Section 3-1.025, "Insurance Policies," of the Standard Specifications, to the Department so that it is received within 10 business days after the bidder has received the contract for execution. Failure to do so shall be just cause for forfeiture of the proposal guaranty. The executed contract documents shall be delivered to the following address: Department of Transportation MS 43, Attn: Office Engineer, 1727 30th Street, Sacramento, CA 95816.

A "Payee Data Record" form will be included in the contract documents to be executed by the successful bidder. The purpose of the form is to facilitate the collection of taxpayer identification data. The form shall be completed and returned to the Department by the successful bidder with the executed contract, contract bonds and the documents identified in Section 3-1.025, "Insurance Policies," of the Standard Specifications,. For the purposes of the form, payee shall be deemed to mean the successful bidder. The form is not to be completed for subcontractors or suppliers. Failure to complete and return the "Payee Data Record" form to the Department as provided herein will result in the retention of 20 percent of payments due the Contractor and penalties of up to $20,000. This retention of payments for failure to complete the "Payee Data Record" form is in addition to any other retention of payments due the Contractor.

Attention is also directed to "Small Business and Non-Small Business Subcontractor Preferences" of these special provisions.

A bidder who is certified as a Small Business by the Office of Small Business and DVBE Services, Department of General Services, will be allowed a preference in the award of this contract under the following conditions:

A. The bidder filled out and signed the "Request for Small Business Preference and Non-Small Business Subcontractor Preference" form, requesting Small Business preference, and attached a copy of its Office of Small Business and DVBE Services small business certification letter to the form; and
B. The apparent low bidder is not certified as a Small Business.

A bidder who is not certified as a Small Business by the Office of Small Business and DVBE Services, Department of General Services, will be allowed a preference in the award of this contract under the following conditions:

A. The bidder filled out and signed the "Request for Small Business Preference and Non-Small Business Subcontractor Preference" form, requesting Non-Small Business Subcontractor preference and notifying the Department that it commits to subcontract at least 25 percent of its bid amount with one or more Small Businesses, and submitted the "CALTRANS BIDDER – SMALL BUSINESS SUBCONTRACTOR – INFORMATION" form listing the subcontractors and suppliers it commits to subcontract with; and
B. The apparent low bidder is not certified as a Small Business, and has not filled out and signed the "Request for Small Business Preference and Non-Small Business Subcontractor Preference."

The Small Business preference will be a reduction in the bid submitted by the Small Business contractor, for bid comparison purposes, by an amount equal to 5 percent of the amount bid by the apparent low bidder, the amount not to exceed $50,000. If this reduction results in the Small Business contractor becoming the low bidder, or in a precise tie with a Non-Small Business apparent low bidder, then the contract will be awarded to the Small Business contractor on the basis of the actual bid of the Small Business contractor notwithstanding the reduced bid price used for bid comparison purposes.

The Non-Small Business Subcontractor preference will be a reduction in the bid submitted by the Non-Small Business contractor requesting the preference, for bid comparison purposes, by an amount equal to 5 percent of the amount bid by the apparent low bidder, the amount not to exceed $50,000. If this reduction results in the Non-Small Business contractor requesting the preference becoming the low bidder, or in a precise tie with a Non-Small Business apparent low bidder not requesting the preference, then the contract will be awarded to the Non-Small Business contractor requesting the preference on the basis of its actual bid notwithstanding the reduced bid price used for bid comparison purposes. Application of the Non-Small Business Subcontractor preference shall not result in the displacement of a Small Business in winning the award.

Attention is also directed to "California Company Preference" of these special provisions.

The amount of the California company reciprocal preference shall be equal to the amount of the preference applied by the state of the nonresident contractor with the lowest responsive bid, except where the "California company" is eligible for a California Small Business Preference or a California Non-Small Business Subcontractor Preference, in which case the preference applied shall be the greater of the two, but not both.

If the bidder submitting the lowest responsive bid is not a "California company" and with the benefit of the reciprocal preference, a "California company's" responsive bid is equal to or less than the original lowest responsive bid, the "California company" will be awarded the contract at its submitted bid price except as provided below.

Small Business bidders shall have precedence over Non-Small Business bidders in that the application of the "California company" preference for which Non-Small Business bidders may be eligible shall not result in the denial of the award to a Small Business bidder.

DVBE bidders shall have precedence over Non-DVBE bidders in that in the event the application of the Small Business preference to more than one bidder results in a precise tie in the bid amounts used for comparison purposes, the award shall go to the DVBE that is also a small business. This precedence shall not apply to the application of the California company reciprocal preference.

SECTION 4. BEGINNING OF WORK, TIME OF COMPLETION, AND LIQUIDATED DAMAGES

The first working day is the sixtieth day after contract approval.

The Contractor shall not begin work at the job site within 60 days after contract approval, except for measuring controlling field dimensions and locating utilities. In addition, the Contractor shall not begin work at the job site until the following submittals are received and approved by the Engineer:

1. Baseline Progress Schedule (Critical Path Method)
2. Storm Water Pollution Prevention Plan (SWPPP)
3. Notification of Dispute Review Board (DRB) nominee and disclosure statement

The Contractor may begin work at the job site before the sixtieth day after contract approval if:

1. The Contractor submits and obtains required approvals for the submittals before the sixtieth day
2. Authorized by the Engineer in writing

The Department will grant time extensions for delays only that are beyond the Contractor's control and that prevent the Contractor from starting work at the job site on the first working day.

The work (except plant establishment work) shall be diligently prosecuted to completion before the expiration of **670 WORKING DAYS.**

The Contractor shall pay to the State of California the sum of $ **6,400.00** per day for each day's delay in finishing the work (except plant establishment work) in excess of the number of working days specified above.

The work (including plant establishment work) shall be diligently prosecuted to completion before the expiration of **920 WORKING DAYS**.

The Contractor shall pay to the State of California the sum of $600 per day for each day's delay in completing the plant establishment work.

In no case will liquidated damages of more than $ **6,400.00** per day be assessed.

SECTION 5. GENERAL

SECTION 5-1. MISCELLANEOUS

5-1.01 GUARANTEE

GENERAL

The Contractor shall guarantee the work is in accordance with contract requirements and remains free from substantial defects in materials and workmanship for a period of one year after contract acceptance. For certain portions of the work where the Director relieves the Contractor of responsibility in accordance with Section 7-1.15, "Relief from Maintenance and Responsibility," of the Standard Specifications, the guarantee period starts on the relief date and ends one year therefrom.

Substantial defects in materials and workmanship means defective work objectively manifested by damaged, displaced, or missing parts or components and workmanship resulting in improper function of materials, components, equipment, or systems, as installed or manufactured by the Contractor, subcontractor, supplier, or manufacturer.

During the guarantee period, the Contractor shall repair or replace contract work and associated work which is not in accordance with contract requirements or has substantial defects in materials and workmanship. The Contractor shall perform the corrective work with no expense to the Department other than State-provided field inspection services.

The guarantee of work excludes damage or displacement that is outside the control of the Contractor and caused by normal wear and tear, improper operation, insufficient maintenance, abuse, unauthorized modification, or natural disaster as described in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications.

The Contractor shall have the same insurance coverage during corrective work operations as prior to contract acceptance, in accordance with Section 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The contract bonds furnished in accordance with Section 3-1.02, "Contract Bonds," of the Standard Specifications must remain in full force and effect during the guarantee period and until all corrective work is complete.

In the case of conflict between this guarantee provision and any warranty provision included in the contract, the warranty provision shall govern for the specific construction product or feature covered.

CORRECTIVE WORK

During the guarantee period, the Department will monitor performance of the highway facilities completed by the Contractor and will perform a thorough review of the contract work at least 60 days before the expiration of the one-year guarantee.

If the Engineer discovers contract work not in compliance with contract requirements or that has substantial defects in materials and workmanship, at any time during the guarantee period, a list of items that require corrective work will be developed and forwarded to the Contractor. Within 15 days of receipt of a list, the Contractor shall submit to the Engineer a detailed plan for performing corrective work. The work plan shall include a start to finish schedule. It shall include a list of labor, equipment, materials, and any special services intended to be used. It shall clearly show related work including traffic control, temporary delineation, and permanent delineation.

The Contractor shall start the corrective and related work within 15 days of receiving notice from the Engineer that the Contractor's work plan is approved. The corrective work shall be diligently prosecuted and completed within the time allotted in the approved work plan.

If the Engineer determines that corrective work, covered by the guarantee, is urgently needed to prevent injury or property damage, the Engineer will give the Contractor a request to start emergency repair work and a list of items that require repair work. The Contractor shall mobilize within 24 hours and diligently perform emergency repair work on the damaged highway facilities. The Contractor shall submit a work plan within 5 days of starting emergency repair work.

If the Contractor fails to commence and execute, with due diligence, corrective work and related work required under the guarantee in the time allotted, the Engineer may proceed to have the work performed by State forces or other forces at the Contractor's expense. Upon demand, the Contractor shall pay all costs incurred by the Department for work performed by State forces or other forces including labor, equipment, material, and special services.

PAYMENT

Full compensation for performing corrective work; and related work such as traffic control, temporary delineation, and permanent delineation, and to maintain insurance coverage and bonds, shall be considered as included in the contract prices paid for the various contract items of work and no separate payment will be made therefor.

5-1.019 COST REDUCTION INCENTIVE

Attention is directed to Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

Prior to preparing a written cost reduction proposal, the Contractor shall request a meeting with the Engineer to discuss the proposal in concept. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, overall merit of the proposal, and review times required by the Department and other agencies.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in contract time, 50 percent of that contract time reduction shall be credited to the State by reducing the contract working days, not including plant establishment. Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions regarding the working days.

If a cost reduction proposal submitted by the Contractor, and subsequently approved by the Engineer, provides for a reduction in traffic congestion or avoids traffic congestion during construction, 60 percent of the estimated net savings in construction costs attributable to the cost reduction proposal will be paid to the Contractor. In addition to the requirements in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications, the Contractor shall provide detailed comparisons of the traffic handling between the existing contract and the proposed change, and estimates of the traffic volumes and congestion.

5-1.02 LABOR NONDISCRIMINATION

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of $5,000 or more.

5-1.03 INTEREST ON PAYMENTS

Interest shall be payable on progress payments, payments after acceptance, final payments, extra work payments, and claim payments as follows:

A. Unpaid progress payments, payment after acceptance, and final payments shall begin to accrue interest 30 days after the Engineer prepares the payment estimate.
B. Unpaid extra work bills shall begin to accrue interest 30 days after preparation of the first pay estimate following receipt of a properly submitted and undisputed extra work bill. To be properly submitted, the bill must be submitted within 7 days of the performance of the extra work and in conformance with the provisions in Section 9-1.03C, "Records," and Section 9-1.06, "Partial Payments," of the Standard Specifications. An undisputed extra work bill not submitted within 7 days of performance of the extra work will begin to accrue interest 30 days after the preparation of the second pay estimate following submittal of the bill.
C. The rate of interest payable for unpaid progress payments, payments after acceptance, final payments, and extra work payments shall be 10 percent per annum.
D. The rate of interest payable on a claim, protest or dispute ultimately allowed under this contract shall be 6 percent per annum. Interest shall begin to accrue 61 days after the Contractor submits to the Engineer information in sufficient detail to enable the Engineer to ascertain the basis and amount of said claim, protest or dispute.

The rate of interest payable on any award in arbitration shall be 6 percent per annum if allowed under the provisions of Civil Code Section 3289.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

A. Excavations-The near edge of the excavation is 12 feet or less from the edge of the lane, except:

    1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
    2. Excavations less than one foot deep.
    3. Trenches less than one foot wide for irrigation pipe or electrical conduit, or excavations less than one foot in diameter.
    4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
    5. Excavations in side slopes, where the slope is steeper than 4:1 (horizontal:vertical).
    6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles-The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
C. Storage Areas-Material or equipment is stored within 12 feet of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the Standard Specifications, shall be offset a minimum of 15 feet from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the Standard Specifications and these special provisions:

Approach Speed of Public Traffic (Posted Limit) (Miles Per Hour)	Work Areas
Over 45	Within 6 feet of a traffic lane but not on a traffic lane
35 to 45	Within 3 feet of a traffic lane but not on a traffic lane

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 10 feet without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

5-1.05 TESTING

Testing of materials and work shall conform to the provisions in Section 6-3, "Testing," of the Standard Specifications and these special provisions.

Whenever the provisions of Section 6-3.01, "General," of the Standard Specifications refer to tests or testing, it shall mean tests to assure the quality and to determine the acceptability of the materials and work.

The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Department, and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.

In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.

If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

5-1.065 SOLID WASTE DISPOSAL AND RECYCLING REPORT

This work shall consist of reporting disposal and recycling of construction solid waste, as specified in these special provisions. For the purposes of this section, solid waste includes construction and demolition waste debris, but not hazardous waste.

Annually by the fifteenth day of January, the Contractor shall complete and certify Form CEM-4401, "Solid Waste Disposal and Recycling Report," which quantifies solid waste generated by the work performed and disposed of in landfills or recycled during the previous calendar year. The amount and type of solid waste disposed of or recycled shall be reported in tons. The Contractor shall also complete and certify Form CEM-4401 within 5 days following contract acceptance.

Form CEM-4401, "Solid Waste Disposal and Recycling Report" can be downloaded at:

http://www.dot.ca.gov/hq/construc/manual2001

If the Contractor has not submitted Form CEM-4401, by the dates specified above, the Department will withhold the amount of $10,000 for each missing or incomplete report. The moneys withheld will be released for payment on the next monthly estimate for partial payment following the date that a complete and acceptable Form CEM-4401 is submitted to the Engineer. Upon completion of all contract work and submittal of the final Form CEM-4401, remaining withheld funds associated with this section, "Solid Waste Disposal and Recycling Report," will be released for payment. Withheld funds in conformance with this section shall be in addition to other moneys withheld provided for in the contract. No interest will be due the Contractor on withheld amounts.

Full compensation for preparing and submitting Form CEM-4401, "Solid Waste Disposal and Recycling Report," shall be considered as included in the contract price for the various items of work involved and no additional compensation will be allowed therefor.

5-1.07 (BLANK)

5-1.08 (Blank)

5-1.09 SUBCONTRACTING

Attention is directed to the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, Section 2, "Proposal Requirements and Conditions," and Section 3, "Award and Execution of Contract," of these special provisions.

Pursuant to the provisions in Section 1777.1 of the Labor Code, the Labor Commissioner publishes and distributes a list of contractors ineligible to perform work as a subcontractor on a public works project. This list of debarred contractors is available from the Department of Industrial Relations web site at:

http://www.dir.ca.gov/DLSE/Debar.html

The first sentence in the third paragraph of Section 8-1.01, "Subcontracting," of the Standard Specifications shall not apply.

Unauthorized substitution of a listed subcontractor may constitute a violation of the "Subletting and Subcontracting Fair Practices Act" and may subject the Contractor to the penalties imposed therein.

5-1.09A DVBE SUBCONTRACTING

The DVBEs listed by the Contractor in response to the provisions in Section 2-1.02B, "Submission of DVBE Information," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified DVBEs, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Unauthorized substitution of a DVBE may also constitute a violation of California Code of Regulations Section 1896.64. The Contractor shall not be entitled to payment for the work or material unless it is performed or supplied by the listed DVBE or by other forces (including those of the Contractor) pursuant to prior written authorization of the Engineer.

The provisions in Section 2-1.02, "Disabled Veteran Business Enterprise (DVBE)," of these special provisions that DVBEs shall be certified on the date bids are opened does not apply to substitutions after award of the contract.

The Contractor shall maintain records of all subcontracts entered into with certified DVBE subcontractors and records of materials purchased from certified DVBE suppliers. The records shall show the name and business address of each DVBE subcontractor or vendor and the total dollar amount actually paid each DVBE subcontractor or vendor.

The Contractor agrees that the awarding department will have the right to review, obtain and copy all records pertaining to performance of DVBEs during the contract. The Contractor agrees to provide the awarding department with any relevant information requested and shall permit access to its premises, upon reasonable notice, during normal business hours for the purpose of interviewing employees and inspecting and copying such books, records, accounts and other material that may be relevant to a matter under investigation for the purpose of determining compliance with Public Contract Code Section 10115 et seq. The Contractor further agrees to maintain such records for a period of three (3) years after final payment under the contract.

5-1.09B NON-SMALL BUSINESS SUBCONTRACTING

The Small Business subcontractors listed by the Contractor in response to the provisions in Section 2-1.03B, "Non-small Business Subcontractor Preference," and Section 3, "Award and Execution of Contract," of these special provisions, which are determined by the Department to be certified as Small Business, shall perform the work and supply the materials for which they are listed, unless the Contractor has received prior written authorization to perform the work with other forces or to obtain the materials from other sources.

Unauthorized substitution of a Small Business subcontractor may also constitute a violation of California Code of Regulations Section 1896.10 and may subject the Contractor to the sanctions referenced therein.

The provisions in Section 2-1.03B, "Non-small Business Subcontractor Preference," of these special provisions that Small Business subcontractors shall be certified on the date bids are opened does not apply to substitutions after award of the contract.

The Contractor shall maintain records of all subcontracts entered into with certified Small Business subcontractors and records of materials purchased from certified Small Business suppliers. The records shall show the name and business address of each Small Business subcontractor or vendor and the total dollar amount actually paid each Small Business subcontractor or vendor.

The Contractor agrees that the awarding department will have the right to review, obtain and copy all records pertaining to performance of Small Businesses during the contract. The Contractor agrees to provide the awarding department with any relevant information requested and shall permit access to its premises, upon reasonable notice, during normal business hours for the purpose of interviewing employees and inspecting and copying such books, records, accounts and other material that may be relevant to a matter under investigation for the purpose of determining compliance with California Code of Regulations Section 1896, et seq. The Contractor further agrees to maintain such records for a period of three (3) years after final payment under the contract.

5-1.10 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code concerning prompt payment to subcontractors.

5-1.103 RECORDS

The Contractor shall maintain cost accounting records for the contract pertaining to, and in such a manner as to provide a clear distinction between, the following 6 categories of costs of work during the life of the contract:

A. Direct costs of contract item work.
B. Direct costs of changes in character in conformance with Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications.
C. Direct costs of extra work in conformance with Section 4-1.03D, "Extra Work," of the Standard Specifications.
D. Direct costs of work not required by the contract and performed for others.
E. Direct costs of work performed under a notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications.
F. Indirect costs of overhead.

Cost accounting records shall include the information specified for daily extra work reports in Section 9-1.03C, "Records," of the Standard Specifications. The requirements for furnishing the Engineer completed daily extra work reports shall only apply to work paid for on a force account basis.

The cost accounting records for the contract shall be maintained separately from other contracts, during the life of the contract, and for a period of not less than 3 years after the date of acceptance of the contract. If the Contractor intends to file claims against the Department, the Contractor shall keep the cost accounting records specified above until complete resolution of all claims has been reached.

5-1.104 INTERNET DAILY EXTRA WORK REPORT

When extra work is being paid for on a force account basis, the Contractor shall submit daily extra work reports in conformance with the provisions in Section 9-1.03C, "Records," of the Standard Specifications and these special provisions.

The Contractor shall send daily extra work reports to the Engineer using the Department's Internet extra work billing system. The reports shall conform to the requirements in the "iCAS User's Guide" (Guide). The Guide is available from the Department, and is also found at:

http://www.dot.ca.gov/hq/construc/ewb/EWB_INSTRUCTION.pdf

The Department will provide system accounts to the Contractor's authorized representatives when at least one of the representatives has received training. The Department will provide system training to at least one of the Contractor's authorized representatives within 30 days of the Contractor's request for training. The Department will assign an account and user identification to the Contractor's authorized representatives, and each Contractor's authorized representative shall maintain a unique password. A daily extra work report that the Contractor's authorized representative sends to the Department using the Internet extra work billing system will be considered signed by the Contractor. A daily extra work report that the Engineer approves using the Internet extra work billing system will be considered signed by the Engineer.

Daily extra work reports that include billing for materials shall be substantiated by a valid copy of a vendor's invoice in conformance to the requirements in Section 9-1.03C, "Records," of the Standard Specifications. Each materials invoice shall clearly identify the relative daily extra work report and the associated cost of the materials. In addition to postal service and parcel service and if approved by the Engineer, invoices may be sent by facsimile or as an electronic-mail attachment.

The Contractor shall maintain the Contractor's interface with the Department's Internet extra work billing system. If the Contractor is using the file transfer process to submit extra work reports, it shall conform to the file transfer format and process defined in the Guide.

5-1.105 ARCHAEOLOGICAL DISCOVERIES

If archaeological materials, including but not limited to human skeletal material and disarticulated human bone, are discovered at the job site, protect and leave undisturbed and in place archaeological materials in accordance with the following codes and these special provisions:

1. California Public Resources Code, Division 5, Chapter 1.7 § 5097.5
2. California Public Resources Code, Division 5, Chapter 1.75 § 5097.98 and § 5097.99
3. California Administrative Code, Title 14 § 4308
4. California Penal Code, Part 1, Title 14 § 622-1/2
5. California Health and Safety Code, Division 7, Part 1, Chapter 2, § 7050.5

Archaeological materials are the physical remains of past human activity and include historic-period archaeological materials and prehistoric Native American archaeological materials. Nonhuman fossils are not considered to be archaeological except when showing direct evidence of human use or alteration or when found in direct physical association with archaeological materials as described in these special provisions.

Historic-period archaeological materials include cultural remains beginning with initial European contact in California, but at least 50 years old. Historical archaeological materials include:

1. Trash deposits or clearly defined disposal pits containing tin cans, bottles, ceramic dishes, or other refuse indicating previous occupation or use of the site
2. Structural remains of stone, brick, concrete, wood, or other building material found above or below ground or
3. Human skeletal remains from the historic period, with or without coffins or caskets, including any associated grave goods

Prehistoric Native American archaeological materials include:

1. Human skeletal remains or associated burial goods such as beads or ornaments
2. Evidence of tool making or hunting such as arrowheads and associated chipping debris of fine-grained materials such as obsidian, chert, or basalt
3. Evidence of plant processing such as pestles, grinding slabs, or stone bowls
4. Evidence of habitation such as cooking pits, stone hearths, packed or burnt earth floors or
5. Remains from food processing such as concentrations of discarded or burnt animal bone, shellfish remains, or burnt rocks used in cooking

Immediately upon discovery of archaeological materials, stop all work within a 60-foot radius of the archaeological materials and immediately notify the Engineer. Archaeological materials found during construction are the property of the State. Do not resume work within the 60-foot radius of the find until the Engineer gives you written approval. If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of an archeological find or investigation or recovery of archeological materials, you will be compensated for resulting losses and an extension of time will be granted in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Department may use other forces to investigate and recover archaeological materials from the location of the find. When ordered by the Engineer furnish labor, material, tools and equipment, to secure the location of the find, and assist in the investigation or recovery of archaeological materials and the cost will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Full compensation for immediately notifying the Engineer upon discovery of archaeological materials and leaving undisturbed and in place archaeological materials discovered on the job site shall be considered as included in the contract price paid for various items of work involved and no additional compensation will be allowed therefor.

5-1.11 PARTNERING

The State will promote the formation of a "Partnering" relationship with the Contractor in order to effectively complete the contract to the benefit of both parties. The purpose of this relationship is to maintain a cooperative communication and to mutually resolve conflicts at the lowest responsible management level.

The Contractor may request the formation of a "Partnering" relationship by submitting a request in writing to the Engineer after approval of the contract. If the Contractor's request for "Partnering" is approved by the Engineer, scheduling of a "Partnering Workshop," selecting the "Partnering" facilitator and workshop site, and other administrative details shall be as agreed to by both parties. If agreed to by the parties, additional "Partnering Workshops" will be conducted as needed throughout the life of the contract.

A one-day "Training in Partnering Concepts" session will be conducted regardless of whether the Contractor requests the formation of a "Partnering" relationship. The "Training in Partnering Concepts" session will be conducted locally for the Contractor's and the Engineer's project representatives. The Contractor shall be represented by a minimum of 2 representatives, one being the Contractor's authorized representative pursuant to Section 5-1.06, "Superintendence," of the Standard Specifications. Scheduling of the "Training in Partnering Concepts" session and selection of the trainer and training site shall be determined cooperatively by the Contractor and the Engineer. If, upon the Contractor's request, "Partnering" is approved by the Engineer, the "Training in Partnering Concepts" session shall be conducted prior to the initial "Partnering Workshop."

The costs involved in providing the "Training in Partnering Concepts" trainer and training site will be borne entirely by the State. The costs will be determined in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor the sum of that cost, except no markups will be allowed.

The costs involved in providing the "Partnering Workshop" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Partnering Workshop" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with "Training in Partnering Concepts" and "Partnering Workshops" will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

The establishment of a "Partnering" relationship will not change or modify the terms and conditions of the contract and will not relieve either party of the legal requirements of the contract.

5-1.114 VALUE ANALYSIS

The Contractor may submit to the Engineer, in writing, a request for a "Value Analysis" workshop. The purpose for having a workshop is to identify value enhancing opportunities and to consider modifications to the plans and specifications that will reduce either the total cost, time of construction or traffic congestion, without impairing, in any manner, the essential functions or characteristics of the project including, but not limited to, service life, economy of operation, ease of maintenance, benefits to the travelling public, desired appearance, or design and safety standards.

To maximize the potential benefits of a workshop, the request should be submitted to the Engineer early in the project after approval of the contract. If the Contractor's request for a "Value Analysis" workshop is approved by the Engineer, scheduling of a workshop, selecting the facilitator and workshop site, and other administrative details shall be determined cooperatively by the Contractor and the Engineer.

The workshop shall be conducted in conformance with the methodology described in the Department's "Value Analysis Team Guide" available at:

http://www.dot.ca.gov/hq/oppd/value/

The facilitator shall be a Certified Value Specialist (CVS) as recognized by the Society of American Value Engineers (SAVE) International, which may be contacted at:

SAVE International
60 Revere Drive
Northbrook, IL 60062
Telephone: (847) 480-1730
FAX: (847) 480-9282

The Contractor may submit recommendations resulting from a "Value Analysis" workshop for approval by the Engineer as cost reduction incentive proposals in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications.

The costs involved in providing the "Value Analysis" facilitator and workshop site will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost in providing the "Value Analysis" facilitator and workshop site in conformance with the provisions in Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost, except no markups will be allowed.

All other costs associated with the "Value Analysis" workshop will be borne separately by the party incurring the costs, such as wages and travel expenses, and no additional compensation will be allowed therefor.

5-1.12 DISPUTE REVIEW BOARD

GENERAL

To assist in the resolution of disputes or potential claims arising out of the work of this project, a Dispute Review Board, hereinafter referred to as the "DRB," shall be established by the Engineer and Contractor cooperatively upon approval of the contract. The DRB is intended to assist the contract administrative claims resolution process as specified in the provisions in Section 9-1.04, "Notice of Potential Claim," and Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications and these special provisions. The DRB shall not serve as a substitute for provisions in the specifications in regard to filing potential claims. The requirements and procedures established in this section shall be a prerequisite to filing a claim, filing for arbitration, or filing for litigation prior or subsequent to project completion.

The DRB shall be utilized when dispute or potential claim resolution at the project level is unsuccessful. The DRB shall function as specified herein until the day of acceptance of the contract, at which time the work of the DRB will cease except for completion of unfinished reports. No DRB dispute meetings shall take place later than 30 days prior to acceptance of contract. After acceptance of contract, disputes or potential claims which have followed the dispute resolution processes of the Standard Specifications and these special provisions, but have not been resolved, shall be stated or restated by the Contractor, in response to the Proposed Final Estimate within the time limits provided in Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. The State will review those claims in conformance with the provisions in Section 9-1.07B of the Standard Specifications. Following the adherence to and completion of the contractual administrative claims procedure, the Contractor may file for arbitration in conformance with the provisions in Section 9-1.10, "Arbitration," of the Standard Specifications and these special provisions.

Disputes, as used in this section, shall include differences of opinion, properly noticed as provided hereinafter, between the State and Contractor on matters related to the work and other subjects considered by the State or Contractor, or by both, to be of concern to the DRB on this project, except matters relating to Contractor, subcontractor or supplier potential claims not actionable against the Department as specified in these special provisions or quantification of disputes for overhead type expenses or costs. Disputes for overhead type expenses or costs shall conform to the requirements of Section 9-1.07B, "Final Payment and Claims," of the Standard Specifications. Whenever the term "dispute" or "disputes" is used herein, it shall be deemed to include potential claims as well as disputes.

The DRB shall serve as an advisory body to assist in the resolution of disputes between the State and the Contractor, hereinafter referred to as the "parties." The DRB shall consider disputes referred to it, and furnish written reports containing findings and recommendations pertaining to those disputes, to the parties to aid in resolution of the differences between them. DRB findings and recommendations are not binding on the parties.

SELECTION PROCESS, DISCLOSURE AND APPOINTMENTS

The DRB shall consist of one member selected by the State and approved by the Contractor, one member selected by the Contractor and approved by the State, and a third member selected by the first 2 members and approved by both the State and the Contractor. The third member shall act as the DRB Chairperson.

DRB members shall be especially knowledgeable in the type of construction and contract documents potentially anticipated by the contract. DRB members shall discharge their responsibilities impartially as an independent body, considering the facts and circumstances related to the matters under consideration, pertinent provisions of the contract and applicable laws and regulations.

The State and the Contractor shall nominate and approve DRB members in conformance with the terms and conditions of the Dispute Review Board Agreement and these special provisions, within 45 days of the approval of the contract. Each party shall provide written notification to the other of the name of their selected DRB nominee along with the prospective member's complete written disclosure statement.

Disclosure statements shall include a resume of the prospective member's experience and a declaration statement describing past, present, anticipated, and planned relationships, including indirect relationships through the prospective member's primary or full-time employer, to this project and with the parties involved in this construction contract, including but not limited to, relevant subcontractors or suppliers to the parties, parties' principals, or parties' counsel. DRB members shall also include a full disclosure of close professional or personal relationships with all key members of the contract. Objections to nominees must be based on a specific breech or violation of nominee responsibilities or on nominee qualifications under these provisions unless otherwise specified. The Contractor or the State may, on a one-time basis, object

to the other's nominee without specifying a reason and this person will not be selected for the DRB. Another person shall then be nominated within 15 days.

The first duty of the State and Contractor selected members of the DRB shall be to select and recommend a prospective third DRB member to the parties for final selection and approval. The first 2 DRB members shall proceed with the selection of the third DRB member immediately upon receiving written notification from the State of their selection, and shall provide their recommendation simultaneously to the parties within 15 days of the notification.

The first 2 DRB members shall select a third DRB member subject to mutual approval of the parties or may mutually concur on a list of potentially acceptable third DRB members and submit the list to the parties for final selection and approval of the third member. The goal in the selection of the third member is to complement the professional experience of the first 2 members and to provide leadership for the DRB's activities.

The third prospective DRB member shall supply a full disclosure statement to the first 2 DRB members and to the parties prior to appointment.

An impasse shall be considered to have been reached if the parties are unable to approve a third member within 15 days of receipt of the recommendation of the first 2 DRB members, or if the first 2 DRB members are unable to agree upon a recommendation within their 15 day time limit. In the event of an impasse in selection of third DRB member the State and the Contractor shall each propose 3 candidates for the third DRB member position. The parties shall select the candidates proposed under this paragraph from the current list of arbitrators certified by the Public Works Contract Arbitration Committee created by Article 7.2 (commencing with Section 10245) of the State Contract Act. The first 2 DRB members shall then select one of the 6 proposed candidates in a blind draw.

No DRB member shall have prior direct involvement in this contract. No member shall have a financial interest in this contract or the parties thereto, within a period of 6 months prior to award of this contract or during the contract, except as follows:

A. Compensation for services on this DRB.
B. Ownership interest in a party or parties, documented by the prospective DRB member, that has been reviewed and determined in writing by the State to be sufficiently insignificant to render the prospective member acceptable to the State.
C. Service as a member of other Dispute Review Boards on other contracts.
D. Retirement payments or pensions received from a party that are not tied to, dependent on or affected by the net worth of the party.
E. The above provisions apply to parties having a financial interest in this contract, including but not limited to contractors, subcontractors, suppliers, consultants, and legal and business services.

The Contractor or the State may reject any of the 3 DRB members who fail to fully comply at all times with all required employment and financial disclosure conditions of DRB membership as described in the Dispute Review Board Agreement and as specified herein. A copy of the Dispute Review Board Agreement is included in this section.

The Contractor, the State, and the 3 members of the DRB shall complete and adhere to the Dispute Review Board Agreement in administration of this DRB within 15 days of the parties' concurrence in the selection of the third member. No DRB meeting shall take place until the Dispute Review Board Agreement has been signed by all parties. The State authorizes the Engineer to execute and administer the terms of the Agreement. The person(s) designated by the Contractor as authorized to execute contract change orders shall be authorized to execute and administer the terms of this agreement, or to delegate the authority in writing. The operation of the DRB shall be in conformance with the terms of the Dispute Review Board Agreement.

COMPENSATION

The State and the Contractor shall bear the costs and expenses of the DRB equally. Each DRB member shall be compensated at an agreed rate of $1,200 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB member shall be compensated at an agreed rate of $700 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time, (such as time spent evaluating and preparing recommendations on specific issues presented to the DRB), has been specifically agreed to in advance by the State and Contractor. Time away from the project, which has been specifically agreed to in advance by the parties, will be compensated at an agreed rate of $125 per hour. The agreed amount of $125 per hour shall include all incidentals including expenses for telephone, fax, and computer services. Members serving on more than one DRB involving the Department, regardless of the number of meetings per day, shall not be paid more than the all inclusive rate per day or rate per hour for an individual project. The State will provide, at no cost to the Contractor,

administrative services such as conference facilities and secretarial services to the DRB. These special provisions and the Dispute Review Board Agreement state the provisions for compensation and expenses of the DRB. DRB members shall be compensated at the same daily and hourly rate. The Contractor shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The State will reimburse the Contractor for the State's share of the costs. There will be no markups applied to expenses connected with the DRB, either by the DRB members or by the Contractor when requesting payment of the State's share of DRB expenses. Regardless of the DRB recommendation, neither party shall be entitled to reimbursement of DRB costs from the other party.

REPLACEMENT OF DRB MEMBERS

Service of a DRB member may be terminated at any time with not less than 15 days notice as follows:

A. The State may terminate service of the State appointed member.
B. The Contractor may terminate service of the Contractor appointed member.
C. Upon the written recommendation of the State and Contractor appointed members for the removal of the third member.
D. Upon resignation of a member.
E. The State or Contractor may terminate the service of any member who fails to fully comply with all required employment and financial disclosure conditions of DRB membership.

When a member of the DRB is replaced, the replacement member shall be appointed in the same manner as the replaced member was appointed. The appointment of a replacement DRB member will begin promptly upon determination of the need for replacement and shall be completed within 15 days. Changes in either of the DRB members chosen by the 2 parties will not require re-selection of the third member, unless both parties agree to such re-selection in writing. The Dispute Review Board Agreement shall be amended to reflect the change of a DRB member.

OPERATION

The following procedure shall be used for dispute resolution:

A. If the Contractor objects to any decision, act or order of the Engineer, the Contractor shall give written notice of potential claim in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications and these special provisions, including the provision of applicable cost documentation; or file written protests or notices in conformance with the provisions in the Standard Specifications and these special provisions.
B. The Engineer will respond, in writing, to the Contractor's written supplemental notice of potential claim within 20 days of receipt of the notice.
C. Within 15 days after receipt of the Engineer's written response, the Contractor shall, if the Contractor still objects, file a written reply with the Engineer, stating clearly and in detail the basis of the objection.
D. Following an objection to the Engineer's written response, the Contractor shall refer the dispute to the DRB if the Contractor wishes to further pursue the objection to the Engineer's decision. The Contractor shall make the referral in writing to the DRB, simultaneously copied to the State, within 21 days after receipt of the written response from the Engineer. The written dispute referral shall describe the disputed matter in individual discrete segments so that it will be clear to both parties and the DRB what discrete elements of the dispute have been resolved, and which remain unresolved, and shall include an estimate of the cost of the affected work and impacts, if any, on project completion.
E. By failing to submit the written notice of referral to the DRB, within 21 days after receipt of the Engineer's written response to the supplemental notice of potential claim, the Contractor waives future claims and arbitration on the matter in contention.
F. The Contractor and the State shall each be afforded an opportunity to be present and to be heard by the DRB, and to offer evidence. Either party furnishing written evidence or documentation to the DRB must furnish copies of such information to the other party a minimum of 15 days prior to the date the DRB is scheduled to convene the meeting for the dispute. Either party shall produce such additional evidence as the DRB may deem necessary to reach an understanding and a determination of the dispute. The party furnishing additional evidence shall furnish copies of such additional evidence to the other party at the same time the evidence is provided to the DRB. The DRB shall not consider evidence not furnished in conformance with the terms specified herein.

G. Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral unless otherwise agreed to by all parties. The DRB shall determine the time and location of the DRB dispute meeting, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of a timely hearing of the dispute.

H. There shall be no participation of either party's attorneys at DRB dispute meetings.

I. There shall be no participation of persons who are not directly involved in the contract or who do not have direct knowledge of the dispute, including but not limited to consultants, except for expert testimony allowed at the discretion of the DRB and with approval prior to the dispute meeting by both parties.

J. The DRB shall furnish a report, containing findings and recommendations as described in the Dispute Review Board Agreement, in writing to both the State and the Contractor. The DRB may request clarifying information of either party within 10 days after the DRB dispute meeting. Requested information shall be submitted to the DRB within 10 days of the DRB request. The DRB shall complete its report, including minority opinion, if any, and submit it to the parties within 30 days of the DRB dispute meeting, except that time extensions may be granted at the request of the DRB with the written concurrence of both parties. The report shall include the facts and circumstances related to the matters under consideration, pertinent provisions of the contract, applicable laws and regulations, and actual costs and time incurred as shown on the Contractor's cost accounting records. The DRB shall make recommendations on the merit of the dispute and, if appropriate, recommend guidelines for determining compensation.

K. Within 30 days after receiving the DRB's report, both the State and the Contractor shall respond to the DRB in writing signifying that the dispute is either resolved or remains unresolved. Failure to provide the written response within the time specified, or a written rejection of the DRB's recommendation or response to a request for reconsideration presented in the report by either party, shall conclusively indicate that the party(s) failing to respond accepts the DRB recommendation. Immediately after responses have been received from both parties, the DRB shall provide copies of both responses to the parties simultaneously. Either party may request clarification of elements of the DRB's report from the DRB prior to responding to the report. The DRB shall consider any clarification request only if submitted within 10 days of receipt of the DRB's report, and if submitted simultaneously in writing to both the DRB and the other party. Each party may submit only one request for clarification for any individual DRB report. The DRB shall respond, in writing, to requests for clarification within 10 days of receipt of such requests.

L. The DRB's recommendations, stated in the DRB's reports, are not binding on either party. Either party may seek a reconsideration of a recommendation of the DRB. The DRB shall only grant a reconsideration based upon submission of new evidence and if the request is submitted within the 30-day time limit specified for response to the DRB's written report. Each party may submit only one request for reconsideration regarding an individual DRB recommendation.

M. If the State and the Contractor are able to resolve their dispute with the aid of the DRB's report, the State and Contractor shall promptly accept and implement the recommendations of the DRB. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the DRB's recommendation, either party may request the DRB to make a recommendation regarding compensation.

N. The State or the Contractor shall not call DRB members who served on the DRB for this contract as witnesses in arbitration proceedings which may arise from this contract, and all documents created by the DRB shall be inadmissible as evidence in subsequent arbitration proceedings, except the DRB's final written reports on each issue brought before it.

O. The State and Contractor shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

P. The DRB members shall have no claim against the State or the Contractor, or both, from claimed harm arising out of the parties' evaluations of the DRB's report.

DISPUTES INVOLVING SUBCONTRACTOR POTENTIAL CLAIMS

For purposes of this section, a "subcontractor potential claim" shall include any potential claim by a subcontractor (including also any pass through potential claims by a lower tier subcontractor or supplier) against the Contractor that is actionable by the Contractor against the Department which arises from the work, services, or materials provided or to be provided in connection with the contract. If the Contractor determines to pursue a dispute against the Department that includes a subcontractor potential claim, the dispute shall be processed and resolved in conformance with these special provisions and in conformance with the following:

A. The Contractor shall identify clearly in submissions pursuant to this section, that portion of the dispute that involves a subcontractor potential claim or potential claims.
B. The Contractor shall include, as part of its submission pursuant to Step D above, a certification (False Claims Act Certification) by the subcontractor's or supplier's officer, partner, or authorized representative with authority to bind the subcontractor and with direct knowledge of the facts underlying the subcontractor potential claim. The Contractor shall submit a certification that the subcontractor potential claim is acknowledged and forwarded by the Contractor. The form for these certifications is available from the Engineer.
C. At DRB dispute meetings involving one or more subcontractor potential claims, the Contractor shall require that each subcontractor involved in the dispute have present an authorized representative with actual knowledge of the facts underlying the subcontractor potential claim to assist in presenting the subcontractor potential claim and to answer questions raised by the DRB members or the Department's representatives.
D. Failure by the Contractor to declare a subcontractor potential claim on behalf of its subcontractor (including lower tier subcontractors' and suppliers' pass through potential claims) at the time of submission of the Contractor's potential claims, as provided hereunder, shall constitute a release of the State by the Contractor of such subcontractor potential claim.
E. The Contractor shall include in all subcontracts under this contract that subcontractors and suppliers of any tier (a) agree to submit subcontractor potential claims to the Contractor in a proper form and in sufficient time to allow processing by the Contractor in conformance with the Dispute Review Board resolution specifications; (b) agree to be bound by the terms of the Dispute Review Board provisions to the extent applicable to subcontractor potential claims; (c) agree that, to the extent a subcontractor potential claim is involved, completion of all steps required under these Dispute Review Board special provisions shall be a condition precedent to pursuit by the subcontractor of other remedies permitted by law, including without limitation of a lawsuit against the Contractor; and (d) agree that the existence of a dispute resolution process for disputes involving subcontractor potential claims shall not be deemed to create any claim, right, or cause of action by any subcontractor or supplier against the Department.

Notwithstanding the foregoing, this Dispute Review Board special provision shall not apply to, and the DRB shall not have the authority to consider, subcontractor potential claims between the subcontractor(s) or supplier(s) and the Contractor that are not actionable by the Contractor against the Department.

DISPUTE REVIEW BOARD AGREEMENT

A copy of the "Dispute Review Board Agreement" to be executed by the Contractor, State and the 3 DRB members after approval of the contract follows:

Form 6202 Rev (09/01/02)

DISPUTE REVIEW BOARD AGREEMENT

_____
(Contract Identification)

Contract No. _____

THIS DISPUTE REVIEW BOARD AGREEMENT, hereinafter called "AGREEMENT", made and entered into this _____ day of _____, _____, between the State of California, acting through the California Department of Transportation and the Director of Transportation, hereinafter called the "STATE," _____ _____ hereinafter called the "CONTRACTOR," and the Dispute Review Board, hereinafter called the "DRB" consisting of the following members:

_____ ,
(Contractor Appointee)

_____ ,
(State Appointee)

and _____
(Third Person)

WITNESSETH, that

WHEREAS, the STATE and the CONTRACTOR, hereinafter called the "parties," are now engaged in the construction on the State Highway project referenced above; and

WHEREAS, the special provisions for the above referenced contract provides for the establishment and operation of the DRB to assist in resolving disputes; and

WHEREAS, the DRB is composed of three members, one selected by the STATE, one selected by the CONTRACTOR, and the third member selected by the other two members and approved by the parties;

NOW THEREFORE, in consideration of the terms, conditions, covenants, and performance contained herein, or attached and incorporated and made a part hereof, the STATE, the CONTRACTOR, and the DRB members hereto agree as follows:

SECTION I DESCRIPTION OF WORK

To assist in the resolution of disputes between the parties, the contract provides for the establishment and the operation of the DRB. The intent of the DRB is to fairly and impartially consider disputes placed before it and provide written recommendations for resolution of these disputes to both parties. The members of this DRB shall perform the services necessary to participate in the DRB's actions as designated in Section II, Scope of Work.

SECTION II SCOPE OF WORK

The scope of work of the DRB includes, but is not limited to, the following:

A. OBJECTIVE

The principal objective of the DRB is to assist in the timely resolution of disputes between the parties arising from performance of this contract. It is not intended for either party to default on their normal responsibility to amicably and fairly settle their differences by indiscriminately assigning them to the DRB. It is intended that the mere existence of the DRB will encourage the parties to resolve disputes without resorting to this review procedure. But when a dispute that is serious enough to warrant the DRB's review does develop, the process for prompt and efficient action will be in place.

B. PROCEDURES

The DRB shall render written reports on disputes between the parties arising from the construction contract. Prior to consideration of a dispute, the DRB shall establish rules and regulations that will govern the conduct of its business and reporting procedures in conformance with the requirements of the contract and the terms of this AGREEMENT. DRB recommendations, resulting from its consideration of a dispute, shall be furnished in writing to both parties. The recommendations shall be based on facts and circumstances involved in the dispute, pertinent contract provisions, applicable laws and regulations. The recommendations shall find one responsible party in a dispute; shared or "jury" determinations shall not be rendered. The DRB shall make recommendations on the merit of the dispute, and if appropriate, recommend guidelines for determining compensation. If the parties cannot agree on compensation within 60 days of the acceptance by both parties of the DRB's recommendation, either party may request the DRB to make a recommendation regarding compensation.

The DRB shall refrain from officially giving advice or consulting services to anyone involved in the contract. The individual members shall act in a completely independent manner and while serving as members of the DRB shall have no consulting business connections with either party or its principals or attorneys or other affiliates (subcontractors, suppliers, etc.) who have a beneficial interest in the contract.

During scheduled meetings of the DRB as well as during dispute meetings, DRB members shall refrain from expressing opinions on the merits of statements on matters under dispute or potential dispute. Opinions of DRB members expressed in private sessions shall be kept strictly confidential. Individual DRB members shall not meet with, or discuss contract issues with individual parties, except as directed by the DRB Chairperson. Such discussions or meetings shall be disclosed to both parties. Other discussions regarding the project between the DRB members and the parties shall be in the presence of all three members and both parties. Individual DRB members shall not undertake independent investigations of any kind pertaining to disputes or potential disputes, except with the knowledge of both parties and as expressly directed by the DRB Chairperson.

C. CONSTRUCTION SITE VISITS, PROGRESS MEETINGS AND FIELD INSPECTIONS

The DRB members shall visit the project site and meet with representatives of the parties to keep abreast of construction activities and to develop familiarity with the work in progress. Scheduled progress meetings shall be held at or near the project site. The DRB shall meet at least once at the start of the project, and at least once every 4 months thereafter. The frequency, exact time, and duration of additional site visits and progress meetings shall be as recommended by the DRB and approved by the parties consistent with the construction activities or matters under consideration and dispute. Each meeting shall consist of a round table discussion and a field inspection of the work being performed on the contract, if necessary. Each meeting shall be attended by representatives of both parties. The agenda shall generally be as follows:

1. Meeting opened by the DRB Chairperson.
2. Remarks by the STATE's representative.
3. A description by the CONTRACTOR's representative of work accomplished since the last meeting; the current schedule status of the work; and a forecast for the coming period.
4. An outline by the CONTRACTOR's representative of potential problems and a description of proposed solutions.
5. An outline by the STATE's representative of the status of the work as the STATE views it.
6. A brief description by the CONTRACTOR's or STATE's representative of potential claims or disputes which have surfaced since the last meeting.
7. A summary by the STATE's representative, the CONTRACTOR's representative, or the DRB of the status of past disputes and potential claims.

The STATE's representative will prepare minutes of all progress meetings and circulate them for revision and approval by all concerned within 10 days of the meeting.

The field inspection shall cover all active segments of the work, the DRB being accompanied by both parties' representatives. The field inspection may be waived upon mutual agreement of the parties.

D. DRB CONSIDERATION AND HANDLING OF DISPUTES

Upon receipt by the DRB of a written referral of a dispute, the DRB shall convene to review and consider the dispute. The dispute meeting shall be held no earlier than 30 days and no later than 60 days after receipt of the written referral, unless otherwise agreed to by all parties. The DRB shall determine the time and location of DRB dispute meetings, with due consideration for the needs and preferences of the parties while recognizing the paramount importance of speedy resolution of issues. No dispute meetings shall take place later than 30 days prior to acceptance of contract.

Normally, dispute meetings shall be conducted at or near the project site. However, any location that would be more convenient and still provide required facilities and access to necessary documentation shall be satisfactory.

Both parties shall be given the opportunity to present their evidence at these dispute meetings. It is expressly understood that the DRB members are to act impartially and independently in the consideration of the contract provisions, applicable laws and regulations, and the facts and conditions surrounding any dispute presented by either party, and that the recommendations concerning any such dispute are advisory and nonbinding on the parties.

The DRB may request that written documentation and arguments from both parties be sent to each DRB member, through the DRB Chairperson, for review before the dispute meeting begins. A party furnishing written documentation to the DRB shall furnish copies of such information to the other party at the same time that such information is supplied to the DRB.

DRB dispute meetings shall be informal. There shall be no testimony under oath or cross-examination. There shall be no reporting of the procedures by a shorthand reporter or by electronic means. Documents and verbal statements shall be received by the DRB in conformance with acceptance standards established by the DRB. These standards need not comply with prescribed legal laws of evidence.

The third DRB member shall act as Chairperson for dispute meetings and all other DRB activities. The parties shall have a representative at all dispute meetings. Failure to attend a duly noticed dispute meeting by either of the parties shall be conclusively considered by the DRB as indication that the non-attending party considers written submittals as their entire and complete argument. The claimant shall discuss the dispute, followed by the other party. Each party shall then be allowed one or more rebuttals until all aspects of the dispute are thoroughly covered. DRB members shall ask questions, seek clarification, and request further data from either of the parties as may be necessary to assist in making a fully informed recommendation. The DRB may request from either party documents or information that would assist the DRB in making its findings and recommendations including, but not limited to, documents used by the CONTRACTOR in preparing the bid for the project. A refusal by a party to provide information requested by the DRB may be considered by the DRB as an indication that the requested material would tend to disprove that party's position. In large or complex cases, additional dispute meetings may be necessary in order to consider all the evidence presented by both parties. All involved parties shall maintain the confidentiality of all documents and information, as provided in this AGREEMENT.

During dispute meetings, no DRB member shall express an opinion concerning the merit of any facet of the case. DRB deliberations shall be conducted in private, with interim individual views kept strictly confidential.

After dispute meetings are concluded, the DRB shall meet in private and reach a conclusion supported by 2 or more members. Private sessions of the DRB may be held at a location other than the job site or by electronic conferencing as deemed appropriate, in order to expedite the process.

The DRB's findings and recommendations, along with discussion of reasons therefor, shall then be submitted as a written report to both parties. Recommendations shall be based on the pertinent contract provisions, applicable laws and regulations, and facts and circumstances related to the dispute. The report shall be thorough in discussing the facts considered, the contract language, law or regulation viewed by the DRB as pertinent to the issues, and the DRB's interpretation and philosophy in arriving at its conclusions and recommendations. The DRB's report shall stand on its own, without attachments or appendices. The DRB Chairperson shall furnish a copy of the written recommendation report to the DRB Coordinator, Division of Construction, MS 44, P.O. Box 942874, Sacramento, CA 94274.

With prior written approval of both parties, the DRB may obtain technical services necessary to adequately review the disputes presented, including audit, geotechnical, schedule analysis and other services. The parties' technical staff may supply those services as appropriate. The cost of technical services, as agreed to by the parties, shall be borne equally by the 2 parties as specified in an approved contract change order. The CONTRACTOR will not be entitled to markups for the payments made for these services.

The DRB shall resist submittal of incremental portions of information by either party, in the interest of making a fully informed decision and recommendation.

The DRB shall make every effort to reach a unanimous decision. If this proves impossible, the dissenting member shall prepare a minority opinion, which shall be included in the DRB's report.

Although both parties should place weight upon the DRB's recommendations, they are not binding. Either party may appeal a recommendation to the DRB for reconsideration. However, reconsideration shall only be allowed when there is new evidence to present, and the DRB shall accept only one appeal from each party pertaining to an individual DRB recommendation. The DRB shall hear appeals in conformance with the terms described in the Section entitled "Dispute Review Board" in the special provisions.

E. DRB MEMBER REPLACEMENT

Should the need arise to appoint a replacement DRB member, the replacement DRB member shall be appointed in the same manner as the original DRB members were appointed. The selection of a replacement DRB member shall begin promptly upon notification of the necessity for a replacement and shall be completed within 15 days. This AGREEMENT shall be amended to indicate change in DRB membership.

SECTION III CONTRACTOR RESPONSIBILITIES

The CONTRACTOR shall furnish to each DRB member one copy of pertinent documents that are or may become necessary for the DRB to perform their function. Pertinent documents are written notices of potential claim, responses to those notices, drawings or sketches, calculations, procedures, schedules, estimates, or other documents which are used in the performance of the work or in justifying or substantiating the CONTRACTOR's position. The CONTRACTOR shall also furnish a copy of such pertinent documents to the STATE, in conformance with the terms outlined in the special provisions.

SECTION IV STATE RESPONSIBILITIES

The STATE will furnish the following services and items:

A. CONTRACT RELATED DOCUMENTS

The STATE will furnish to each DRB member one copy of Notice to Contractors and Special Provisions, Proposal and Contract, Plans, Standard Specifications, and Standard Plans, change orders, written instructions issued by the STATE to the CONTRACTOR, or other documents pertinent to any dispute that has been referred to the DRB and necessary for the DRB to perform its function.

B. COORDINATION AND SERVICES

The STATE, through the Engineer, will, in cooperation with the CONTRACTOR, coordinate the operations of the DRB. The Engineer will arrange or provide conference facilities at or near the project site and provide secretarial and copying services to the DRB without charge to the CONTRACTOR.

SECTION V TIME FOR BEGINNING AND COMPLETION

Once established, the DRB shall be in operation until the day of acceptance of the contract. The DRB members shall not begin work under the terms of this AGREEMENT until authorized in writing by the STATE.

SECTION VI PAYMENT

A. ALL INCLUSIVE RATE PAYMENT

The STATE and the CONTRACTOR shall bear the costs and expenses of the DRB equally. Each DRB member shall be compensated at an agreed rate of $1,200 per day if time spent per meeting, including on-site time plus one hour of travel time, is greater than 4 hours. Each DRB member shall be compensated at an agreed rate of $700 per day if time spent per meeting, including on-site time plus one hour of travel time, is less than or equal to 4 hours. The agreed rates shall be considered full compensation for on-site time, travel expenses, transportation, lodging, time for travel and incidentals for each day, or portion thereof, that the DRB member is at an authorized DRB meeting. No additional compensation will be made for time spent by DRB members in review and research activities outside the official DRB meetings unless that time has been specifically agreed to in advance by the STATE and CONTRACTOR. Time away from the project that has been specifically agreed to in advance by the parties will be compensated at an agreed rate of $125 per hour. The agreed amount of $125 per hour shall include all incidentals including expenses for telephone, fax, and computer services. Members serving on more than one DRB involving the State, regardless of the number of meetings per day, shall not be paid more than the all inclusive rate per day or rate per hour for an individual project. The STATE will provide, at no cost to the CONTRACTOR, administrative services such as conference facilities and secretarial services to the DRB.

B. PAYMENTS

DRB members shall be compensated at the same rate. The CONTRACTOR shall make direct payments to each DRB member for their participation in authorized meetings and approved hourly rate charges from invoices submitted by each DRB member. The STATE will reimburse the CONTRACTOR for its share of the costs of the DRB.

The DRB members may submit invoices to the CONTRACTOR for partial payment for work performed and services rendered for their participation in authorized meetings not more often than once per month during the progress of the work. The invoices shall be in a format approved by the parties and accompanied by a general description of activities performed during that billing period. Payment for hourly fees, at the agreed rate, shall not be paid to a DRB member until the amount and extent of those fees are approved by the STATE and CONTRACTOR.

Invoices shall be accompanied by original supporting documents, which the CONTRACTOR shall include with the extra work billing when submitting for reimbursement of the STATE's share of cost from the STATE. The CONTRACTOR will be reimbursed for one-half of approved costs of the DRB. No markups will be added to the CONTRACTOR's payment.

C. INSPECTION OF COSTS RECORDS

The DRB members and the CONTRACTOR shall keep available for inspection by representatives of the STATE and the United States, for a period of 3 years after final payment, the cost records and accounts pertaining to this AGREEMENT. If any litigation, claim, or audit arising out of, in connection with, or related to this contract is initiated before the expiration of the 3-year period, the cost records and accounts shall be retained until such litigation, claim, or audit involving the records is completed.

SECTION VII ASSIGNMENT OF TASKS OF WORK

The DRB members shall not assign the work of this AGREEMENT.

SECTION VIII TERMINATION OF DRB MEMBERS

DRB members may resign from the DRB by providing not less than 15 days written notice of the resignation to the STATE and CONTRACTOR. DRB members may be terminated by their original appointing power or by either party, for failing to fully comply at all times with all required employment and financial disclosure conditions of DRB membership in conformance with the terms of the contract.

SECTION IX LEGAL RELATIONS

The parties hereto mutually understand and agree that the DRB member in the performance of duties on the DRB, is acting in the capacity of an independent agent and not as an employee of either party.

No party to this AGREEMENT shall bear a greater responsibility for damages or personal injury than is normally provided by Federal or State of California Law.

Notwithstanding the provisions of this contract that require the CONTRACTOR to indemnify and hold harmless the STATE, the parties shall jointly indemnify and hold harmless the DRB members from and against all claims, damages, losses, and expenses, including but not limited to attorney's fees, arising out of and resulting from the findings and recommendations of the DRB.

SECTION X CONFIDENTIALITY

The parties hereto mutually understand and agree that all documents and records provided by the parties in reference to issues brought before the DRB, which documents and records are marked "Confidential - for use by the DRB only," shall be kept in confidence and used only for the purpose of resolution of subject disputes, and for assisting in development of DRB findings and recommendations; that such documents and records will not be utilized or revealed to others, except to officials of the parties who are authorized to act on the subject disputes, for any purposes, during the life of the DRB. Upon termination of this AGREEMENT, said confidential documents and records, and all copies thereof, shall be returned to the parties who furnished them to the DRB. However, the parties understand that such documents shall be subsequently discoverable and admissible in court or arbitration proceedings unless a protective order has been obtained by the party seeking further confidentiality.

SECTION XI DISPUTES

Disputes between the parties hereto, including disputes between the DRB members and either party or both parties, arising out of the work or other terms of this AGREEMENT, which cannot be resolved by negotiation and mutual concurrence between the parties, or through the administrative process provided in the contract, shall be resolved by arbitration as provided in Section 9-1.10, "Arbitration," of the Standard Specifications.

SECTION XII VENUE, APPLICABLE LAW, AND PERSONAL JURISDICTION

In the event that any party, including an individual member of the DRB, deems it necessary to institute arbitration proceedings to enforce any right or obligation under this AGREEMENT, the parties hereto agree that such action shall be initiated in the Office of Administrative Hearings of the State of California. The parties hereto agree that all questions shall be resolved by arbitration by application of California law and that the parties to such arbitration shall have the right of appeal from such decisions to the Superior Court in conformance with the laws of the State of California. Venue for the arbitration shall be Sacramento or any other location as agreed to by the parties.

SECTION XIII FEDERAL REVIEW AND REQUIREMENTS

On Federal-Aid contracts, the Federal Highway Administration shall have the right to review the work of the DRB in progress, except for private meetings or deliberations of the DRB.

Other Federal requirements in this agreement shall only apply to Federal-Aid contracts.

SECTION XIV CERTIFICATION OF THE CONTRACTOR, THE DRB MEMBERS, AND THE STATE

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT as of the day and year first above written.

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title: _____

DRB MEMBER

By: _____

Title: _____

CONTRACTOR

By: _____

Title: _____

CALIFORNIA STATE DEPARTMENT
OF TRANSPORTATION

By: _____

Title: _____

5-1.13 FORCE ACCOUNT PAYMENT

Payment for extra work at force account will be determined by either non-subcontracted or subcontracted force account payment unless otherwise specified.

Non-Subcontracted Force Account Payment

When extra work to be paid for on a force account basis is performed by the Contractor, compensation will be determined in accordance with Section 9-1.03, "Force Account Payment," of the Standard Specifications and these special provisions.

The second, third and fourth paragraphs of Section 9-1.03A, "Work Performed by Contractor," of the Standard Specifications shall not apply.

Attention is directed to "Time-Related Overhead" of these special provisions.

To the total of the direct costs for work performed on a force account basis, computed as provided in Section 9-1.03A(1), "Labor," Section 9-1.03A(2), "Materials," and Section 9-1.03A(3), "Equipment Rental," of the Standard Specifications, there will be added the following markups:

Cost	Percent Markup
Labor	28
Materials	10
Equipment Rental	10

The above markups shall be applied to work performed on a force account basis, regardless of whether the work revises the current contract completion date.

The above markups, together with payments made for time-related overhead pursuant to "Time-Related Overhead" of these special provisions, shall constitute full compensation for all overhead costs for work performed on a force account basis. These overhead costs shall be deemed to include all items of expense not specifically designated as cost or equipment rental in conformance with the provisions in Section 9-1.03A(1), "Labor," Section 9-1.03A(2), "Materials," and Section 9-1.03A(3), "Equipment Rental," of the Standard Specifications. The total payment made as provided above and in the first paragraph of Section 9-1.03A, "Work Performed by Contractor," of the Standard Specifications shall be deemed to be the actual cost of the work performed on a force account basis, and shall constitute full compensation therefor.

Full compensation for overhead costs for work performed on a force account basis, and for which no adjustment is made to the quantity for time-related overhead conforming to the provisions in "Time-Related Overhead" of these special provisions, shall be considered as included in the markups specified above, and no additional compensation will be allowed therefor.

Subcontracted Force Account Payment

When extra work to be paid for on a force account basis is performed by a subcontractor approved in conformance with the provisions in Section 8-1.01, "Subcontracting," of the Standard Specifications, compensation will be determined in accordance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications.

5-1.14 COMPENSATION ADJUSTMENTS FOR PRICE INDEX FLUCTUATIONS

The provisions of this section shall apply only to the following contract items:

ITEM CODE	ITEM
390102	ASPHALT CONCRETE (TYPE A)

The compensation payable for paving asphalt used in asphalt concrete will be increased or decreased in conformance with the provisions of this section for paving asphalt price fluctuations exceeding 10 percent (Iu/Ib is greater than 1.10 or less than 0.90) which occur during performance of the work.

The adjustment in compensation will be determined in conformance with the following formulae when the item of asphalt concrete is included in a monthly estimate:

A. Total monthly adjustment = AQ
B. For an increase in paving asphalt price index exceeding 10 percent:

$$A = 0.90 (Iu/Ib - 1.10) Ib$$

C. For a decrease in paving asphalt price index exceeding 10 percent:

$$A = 0.90 (Iu/Ib - 0.90) Ib$$

D. Where:

A = Adjustment in dollars per ton of paving asphalt used to produce asphalt concrete rounded to the nearest $0.01.
Iu = The California Statewide Paving Asphalt Price Index which is in effect on the first business day of the month within the pay period in which the quantity subject to adjustment was included in the estimate.
Ib = The California Statewide Paving Asphalt Price Index for the month in which the bid opening for the project occurred.
Q = Quantity in tons of paving asphalt that was used in producing the quantity of asphalt concrete shown under "This Estimate" on the monthly estimate using the amount of asphalt determined by the Engineer.

The adjustment in compensation will also be subject to the following:

A. The compensation adjustments provided herein will be shown separately on payment estimates. The Contractor shall be liable to the State for decreased compensation adjustments and the Department may deduct the amount thereof from moneys due or that may become due the Contractor.
B. Compensation adjustments made under this section will be taken into account in making adjustments in conformance with the provisions in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.
C. In the event of an overrun of contract time, adjustment in compensation for paving asphalt included in estimates during the overrun period will be determined using the California Statewide Paving Asphalt Price Index in effect on the first business day of the month within the pay period in which the overrun began.

The California Statewide Paving Asphalt Price Index is determined each month on the first business day of the month by the Department using the median of posted prices in effect as posted by Chevron, ExxonMobil, and Union 76 for the Buena Vista, Huntington Beach, and Midway Sunset fields.

In the event that the companies discontinue posting their prices for a field, the Department will determine an index from the remaining posted prices. The Department reserves the right to include in the index determination the posted prices of additional fields.

The California Statewide Paving Asphalt Price Index is available on the Division of Engineering Services website at:

http://www.dot.ca.gov/hq/esc/oe/asphalt_index/astable.html

5-1.15 AREAS FOR CONTRACTOR'S USE

Attention is directed to the provisions in Section 7-1.19, "Rights in Land and Improvements," of the Standard Specifications and these special provisions.

The State property shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy State property, or allow others to occupy the State property, for purposes which are not necessary to perform the required work.

No State-owned parcels adjacent to the right of way are available for the exclusive use of the Contractor within the contract limits. The Contractor shall secure, at the Contractor's own expense, areas required for plant sites, storage of equipment or materials, or for other purposes.

No area is available within the contract limits for the exclusive use of the Contractor. However, temporary storage of equipment and materials on State property may be arranged with the Engineer, subject to the prior demands of State maintenance forces and to other contract requirements. Use of the Contractor's work areas and other State-owned property shall be at the Contractor's own risk, and the State shall not be held liable for damage to or loss of materials or equipment located within such areas.

5-1.16 PAYMENTS

Attention is directed to Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications and these special provisions.

For the purpose of making partial payments pursuant to Section 9-1.06, "Partial Payments," of the Standard Specifications, the amount set forth for the contract items of work hereinafter listed shall be deemed to be the maximum value of the contract item of work which will be recognized for progress payment purposes:

A.	Develop Water Supply	$10,000
B.	Progress Schedule (Critical Path Method)	$10,000
C.	Construction Site Management	$66,250

After acceptance of the contract pursuant to the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, the amount, if any, payable for a contract item of work in excess of the maximum value for progress payment purposes hereinabove listed for the item, will be included for payment in the first estimate made after acceptance of the contract.

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

A. Culvert Pipes
B. Corrugated Steel Pipe
C. Chain Link Fence
D. Ornamental Steel Fence and Gates
E. Sewer Pipes and Appurtenances
F. Lighting Standard and Luminaires
G. Corrugated Steel Pipe Conduits
H. Miscellaneous Iron and Steel
I. Pipe (Irrigation Systems)
J. Sprinklers Valves and Valve Boxes
K. Water and Irrigation Backflow Preventers
L. Water and Irrigation Backflow Preventer Assemblies and Enclosures
M. Irrigation Backflow Irrigation Controller Enclosure Cabinets

5-1.17 PROJECT INFORMATION

The information in this section has been compiled specifically for this project and is made available for bidders and Contractors. Other information referenced in the Standard Specifications and these special provisions do not appear in this section. The information is subject to the conditions and limitations set forth in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," and Section 6-2, "Local Materials," of the Standard Specifications. Bidders and Contractors shall be responsible for knowing the procedures for obtaining information.

Information included in the Information Handout provided to bidders and Contractors is as follows:

A. Foundation Report

Cross sections are not available for this project.

5-1.18 RELATIONS WITH CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

This project lies within the boundaries of the San Diego Regional Water Quality Control Board (RWQCB).

The State Water Resources Control Board (SWRCB) has issued to the Department a permit that governs storm water and non-storm water discharges from the Department's properties, facilities, and activities. The Department's permit is entitled "Order No. 99 - 06 - DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)." Copies of the Department's permit are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254, and may also be obtained at:

http://www.swrcb.ca.gov/stormwtr/caltrans.html

The Department's permit references and incorporates by reference the current statewide general permit issued by the SWRCB entitled "Order No. 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity" that regulates discharges of storm water and non-storm water from construction activities disturbing one acre or more of soil in a common plan of development. Sampling and analysis requirements as specified in SWRCB Resolution No. 2001-46 are added to the statewide general permit. Copies of the statewide permit and modifications thereto are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254 and may also be obtained at:

http://www.swrcb.ca.gov/stormwtr/construction.html

The NPDES permits that regulate this project, as referenced above, are collectively referred to in this section as the "permits."

This project shall conform to the permits and modifications thereto. The Contractor shall maintain copies of the permits at the project site and shall make them available during construction.

The Contractor shall know and comply with provisions of Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to be Observed," 7-1.11, "Preservation of Property," and 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The Contractor shall be responsible for penalties assessed on the Contractor or the Department as a result of the Contractor's failure to comply with the provisions in "Water Pollution Control" of these special provisions or with the applicable provisions of the Federal, State, and local regulations and requirements.

Penalties as used in this section shall include fines, penalties, and damages, whether proposed, assessed, or levied against the Department or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

WITHHOLDS

The Department will withhold money due the Contractor, in an amount estimated by the Department, to include the full amount of penalties and mitigation costs proposed, assessed, or levied as a result of the Contractor's violation of the permits, or Federal or State law, regulations, or requirements. Funds will be withheld by the Department until final disposition of these costs has been made. The Contractor shall remain liable for the full amount until the potential liability is finally resolved with the entity seeking the penalties. Instead of the withhold, the Contractor may provide a suitable bond in favor of the Department to cover the highest estimated liability for any disputed penalties proposed as a result of the Contractor's violation of the permits, law, regulations, or requirements.

If a regulatory agency identifies a failure to comply with the permits and modifications thereto, or other Federal, State, or local requirements, the Department will withhold money due the Contractor, subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to withhold funds from payments which may become due to the Contractor before acceptance of the contract. Funds withheld after acceptance of the contract will be made without prior notice to the Contractor.
B. No withholds of additional amounts out of payments will be made if the amount to be withheld does not exceed the amount being withheld from partial payments in accordance with Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has withheld funds and it is subsequently determined that the State is not subject to the entire amount of the costs and liabilities assessed or proposed in connection with the matter for which the withhold was made, the Department will return the excess amount withheld to the Contractor in the progress payment following the determination. If the matter is resolved for less than the amount withheld, the Department will pay interest at a rate of 6 percent per year on the excess withhold.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the Department shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

5-1.19 PRESERVATION OF PROPERTY

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications and these special provisions.

Existing trees, shrubs and other plants, that are not to be removed as shown on the plans or specified in these special provisions, and are injured or damaged by reason of the Contractor's operations, shall be replaced by the Contractor. The minimum size of tree replacement shall be 24 inch box and the minimum size of shrub replacement shall be 15-gallon. Replacement ground cover plants shall be from flats and shall be planted 12 inches on center. Replacement planting shall conform to the requirements in Section 20-4.07, "Replacement," of the Standard Specifications. The Contractor shall water replacement plants in conformance with the provisions in Section 20-4.06, "Watering," of the Standard Specifications.

Damaged or injured plants shall be removed and disposed of in conformance with the provisions in Section 7-l.13,"Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. At the option of the Contractor, removed trees may be reduced to chips. The chipped material shall be spread within the project limits at locations designated by the Engineer.

Replacement planting of injured or damaged trees, shrubs, and other plants shall be completed prior to the start of the plant establishment period. Replacement planting shall conform to the provisions in Section 20-4.05, "Planting," of the Standard Specifications.

5-1.20 DAMAGE REPAIR

Attention is directed to Section 7-1.16, "Contractor's Responsibility for the Work and Materials," and Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications and these special provisions.

When as a result of freezing conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacement work will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications. A freezing condition, for the purpose of this specification, occurs when the temperature at or near the affected area has been officially recorded below 32° F and plants have been killed or damaged to the degree described above.

When, as a result of drought conditions (as defined herein) during the plant establishment period, plants have died or, in the opinion of the Engineer, have deteriorated to a point beyond which the plants will not mature as typical examples of their species, the Engineer may direct replacement of the affected plants. The total cost of ordered plant replacements, after water has been restricted or stopped, will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications. Restriction or shutoff of available water shall not relieve the Contractor from performing other contract work. A drought condition occurs when the Department, or its supplier, restricts or stops delivery of water to the Contractor to the degree that plants have died or deteriorated as described above.

When the provisions in Section 7-1.165, "Damage by Storm, Flood, Tsunami or Earthquake," of the Standard Specifications are applicable, the provisions above for payment of costs for repair of damage due to rain, freezing conditions and drought shall not apply.

5-1.21 RELIEF FROM MAINTENANCE AND RESPONSIBILITY

The Contractor may be relieved of the duty of maintenance and protection for those items not directly connected with plant establishment work in conformance with the provisions in Section 7-1.15, "Relief From Maintenance and Responsibility," of the Standard Specifications. Water pollution control, shall not be relieved of maintenance.

SECTION 6. (BLANK)

SECTION 7. (BLANK)

SECTION 8. MATERIALS

SECTION 8-1. MISCELLANEOUS

8-1.01 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.

The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.

For those categories of materials included on the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included on the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

PAVEMENT MARKERS, PERMANENT TYPE

Retroreflective With Abrasion Resistant Surface (ARS)

1. Apex, Model 921AR (4" x 4")
2. Ennis Paint, Models C88 (4" x 4"), 911 (4" x 4") and 953 (2.75" x 4.5")
3. Ray-O-Lite, Model "AA" ARS (4" x 4")
4. 3M Series 290 (3.5" x 4")
5. 3M Series 290 PSA, with pressure sensitive adhesive pad (3.5" x 4")

Retroreflective With Abrasion Resistant Surface (ARS)

(for recessed applications only)

1. Ennis Paint, Model 948 (2.3" x 4.7")
2. Ennis Paint, Model 944SB (2" x 4")*
3. Ray-O-Lite, Model 2002 (2" x 4.6")
4. Ray-O-Lite, Model 2004 ARS (2" x 4")*

*For use only in 4.5 inch wide (older) recessed slots

Non-Reflective, 4-inch Round

1. Apex Universal (Ceramic)
2. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
3. Glowlite, Inc. (Ceramic)
4. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
5. Interstate Sales, "Diamond Back" (Polypropylene)
6. Novabrite Models Cdot (White) Cdot-y (Yellow), Ceramic
7. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene
8. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)

PAVEMENT MARKERS, TEMPORARY TYPE

Temporary Markers For Long Term Day/Night Use (180 days or less)

1. Vega Molded Products "Temporary Road Marker" (3" x 4")

Temporary Markers For Short Term Day/Night Use (14 days or less)

(For seal coat or chip seal applications, clear protective covers are required)

1. Apex Universal, Model 932
2. Filtrona Extrusion, Models T.O.M., T.R.P.M., and "HH" (High Heat)
3. Hi-Way Safety, Inc., Model 1280/1281
4. Glowlite, Inc., Model 932

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

1. Advanced Traffic Marking, Series 300 and 400
2. Brite-Line, Series 1000
3. Brite-Line, "DeltaLine XRP"
4. Swarco Industries, "Director 35" (For transverse application only)
5. Swarco Industries, "Director 60"
6. 3M, "Stamark" Series 380 and 5730
7. 3M, "Stamark" Series 420 (For transverse application only)

Temporary (Removable) Striping and Pavement Marking Tape (180 days or less)

1. Advanced Traffic Marking, Series 200
2. Brite-Line, Series 100
3. Garlock Rubber Technologies, Series 2000
4. P.B. Laminations, Aztec, Grade 102
5. Swarco Industries, "Director-2"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", and Series A750

8. 3M Series A145, Removable Black Line Mask
   (Black Tape: for use only on Asphalt Concrete Surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"
   (Black Tape: for use only on Asphalt Concrete Surfaces)
10. Brite-Line "BTR" Black Removable Tape
    (Black Tape: for use only on Asphalt Concrete Surfaces)
11. Trelleborg Industries, RB-140
    (Black Tape: for use only on Asphalt Concrete Surfaces)

Preformed Thermoplastic (Heated in place)

1. Flint Trading Inc., "Hot Tape"
2. Flint Trading Inc., "Premark Plus"
3. Ennis Paint Inc., "Flametape"

Ceramic Surfacing Laminate, 6" x 6"

1. Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 66-inch

1. Filtrona Extrusion, "Flexi-Guide Models 400 and 566"
2. Carsonite, Curve-Flex CFRM-400
3. Carsonite, Roadmarker CRM-375
4. FlexStake, Model 654 TM
5. GreenLine Model CGD1-66

Special Use Type, 66-inch

1. Filtrona Extrusion, Model FG 560 (with 18-inch U-Channel base)
2. Carsonite, "Survivor" (with 18-inch U-Channel base)
3. Carsonite, Roadmarker CRM-375 (with 18-inch U-Channel base)
4. FlexStake, Model 604
5. GreenLine Model CGD (with 18-inch U-Channel base)
6. Impact Recovery Model D36, with #105 Driveable Base
7. Safe-Hit with 8-inch pavement anchor (SH248-GP1)
8. Safe-Hit with 15-inch soil anchor (SH248-GP2) and with 18-inch soil anchor (SH248-GP3)

Surface Mount Type, 48-inch

1. Bent Manufacturing Company, Masterflex Model MF-180EX-48
2. Carsonite, "Channelizer"
3. FlexStake, Models 704, 754 TM, and EB4
4. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base
5. Three D Traffic Works "Channelflex" ID No. 522248W

CHANNELIZERS

Surface Mount Type, 36-inch

1. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
2. Filtrona Extrusion, Flexi-Guide Models FG300PE, FG300UR, and FG300EFX
3. Carsonite, "Super Duck" (Round SDR-336)
4. Carsonite, Model SDCF03601MB "Channelizer"
5. FlexStake, Models 703, 753 TM, and EB3
6. GreenLine, Model SMD-36
7. Hi-way Safety, Inc. "Channel Guide Channelizer" Model CGC36
8. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
9. Safe-Hit, Guide Post, Model SH236SMA
10. Three D Traffic Works "Boomerang" ID No. 522053W

Lane Separation System

1. Filtrona Extrusion, "Flexi-Guide (FG) 300 Curb System"
2. Qwick Kurb, "Klemmfix Guide System"
3. Dura-Curb System

CONICAL DELINEATORS, 42-inch

(For 28-inch Traffic Cones, see Standard Specifications)

1. Bent Manufacturing Company "T-Top"
2. Plastic Safety Systems "Navigator-42"
3. TrafFix Devices "Grabber"
4. Three D Traffic Works "Ringtop" TD7000, ID No. 742143
5. Three D Traffic Works, TD7500

OBJECT MARKERS

Type "K", 18-inch

1. Filtrona Extrusion, Model FG318PE
2. Carsonite, Model SMD 615
3. FlexStake, Model 701 KM
4. Safe-Hit, Model SH718SMA

Type "K-4" / "Q" Object Markers, 24-inch

1. Bent Manufacturing "Masterflex" Model MF-360-24
2. Filtrona Extrusion, Model FG324PE
3. Carsonite, "Channelizer"
4. FlexStake, Model 701KM
5. Safe-Hit, Models SH824SMA_WA and SH824GP3_WA
6. Three D Traffic Works ID No. 531702W and TD 5200
7. Three D Traffic Works ID No. 520896W

CONCRETE BARRIER MARKERS AND
TEMPORARY RAILING (TYPE K) REFLECTORS

Impactable Type

1. ARTUK, "FB"
2. Filtrona Extrusion, Models PCBM-12 and PCBM-T12
3. Duraflex Corp., "Flexx 2020" and "Electriflexx"
4. Hi-Way Safety, Inc., Model GMKRM100
5. Plastic Safety Systems "BAM" Models OM-BARR and OM-BWAR
6. Three D Traffic Works "Roadguide" Model TD 9304

Non-Impactable Type

1. ARTUK, JD Series
2. Plastic Safety Systems "BAM" Models OM-BITARW and OM-BITARA
3. Vega Molded Products, Models GBM and JD
4. Plastic Vacuum Forming, "Cap-It C400"

METAL BEAM GUARD RAIL POST MARKERS

(For use to the left of traffic)

1. Filtrona Extrusion, "Mini" (3" x 10")
2. Creative Building Products, "Dura-Bull, Model 11201"
3. Duraflex Corp., "Railrider"
4. Plastic Vacuum Forming, "Cap-It C300"

CONCRETE BARRIER DELINEATORS, 16-inch

(For use to the right of traffic)

1. Filtrona Extrusion, Model PCBM T-16
2. Safe-Hit, Model SH216RBM

CONCRETE BARRIER-MOUNTED MINI-DRUM (10" x 14" x 22")

1. Stinson Equipment Company "SaddleMarker"

GUARD RAILING DELINEATOR

(Place top of reflective element at 48 inches above plane of roadway)

Wood Post Type, 27-inch

1. Filtrona Extrusion, FG 427 and FG 527
2. Carsonite, Model 427
3. FlexStake, Model 102 GR
4. GreenLine GRD 27
5. Safe-Hit, Model SH227GRD
6. Three D Traffic Works "Guardflex" TD9100
7. New Directions Mfg, NDM27

Steel Post Type

1. Carsonite, Model CFGR-327

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

1. Avery Dennison T-6500 Series (For rigid substrate devices only)
2. Avery Dennison WR-7100 Series
3. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
4. Reflexite, PC-1000 Metalized Polycarbonate
5. Reflexite, AC-1000 Acrylic
6. Reflexite, AP-1000 Metalized Polyester
7. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
8. 3M, High Intensity

Traffic Cones, 4-inch and 6-inch Sleeves

1. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
2. Reflexite, Vinyl, "TR" (Semi-transparent) or "Conformalight"
3. 3M Series 3840
4. Avery Dennison S-9000C

Drums

1. Avery Dennison WR-6100
2. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
3. Reflexite, "Conformalight", "Super High Intensity" or "High Impact Drum Sheeting"
4. 3M Series 3810

Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Nippon Carbide Industries, CN8117
2. Avery Dennison, W 1100 series
3. 3M Series CW 44

Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, W-2100 Series

Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, T-2500 Series
2. Nippon Carbide Industries, Nikkalite 18000

Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)

1. Avery Dennison, T-5500A and T-6500 Series
2. Nippon Carbide Industries, Nikkalite Brand Ultralite Grade II
3. 3M 3870 and 3930 Series

Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-6500 Series
2. Nippon Carbide Industries, Crystal Grade, 94000 Series
3. Nippon Carbide Industries, Model No. 94847 Fluorescent Orange
4. 3M Series 3930 and Series 3924S

Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive

1. Avery Dennison, WU-6014
2. Novabrite LLC, "Econobrite"
3. Reflexite "Vinyl"
4. Reflexite "SuperBright"
5. Reflexite "Marathon"
6. 3M Series RS20

Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

1. 3M Series 3924S, Fluorescent Orange
2. 3M LDP Series 3970

Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-7500 Series
2. Avery Dennison, T-7511 Fluorescent Yellow
3. Avery Dennison, T-7513 Fluorescent Yellow Green
4. Avery Dennison, W-7514 Fluorescent Orange
5. Nippon Carbide Industries, Nikkalite Crystal Grade Series 92800
6. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92847 Fluorescent Orange

Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)

1. 3M VIP Series 3981 Diamond Grade Fluorescent Yellow
2. 3M VIP Series 3983 Diamond Grade Fluorescent Yellow/Green
3. 3M VIP Series 3990 Diamond Grade
4. Avery Dennison T-9500 Series
5. Avery Dennison, T9513, Fluorescent Yellow Green
6. Avery Dennison, W9514, Fluorescent Orange

SPECIALTY SIGNS

1. Reflexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

ALTERNATIVE SIGN SUBSTRATES

Fiberglass Reinforced Plastic (FRP) and Expanded Foam PVC

1. Fiber-Brite (FRP)
2. Sequentia, "Polyplate" (FRP)
3. Inteplast Group "InteCel" (0.5 inch for Post-Mounted CZ Signs, 48-inch or less)(PVC)

Aluminum Composite, Temporary Construction Signs Only

1. Alcan Composites "Dibond Material, 80 mils"
2. Mitsubishi Chemical America, Alpolic 350

8-1.02 STATE-FURNISHED MATERIALS

Attention is directed to Section 6-1.02, "State-Furnished Materials," of the Standard Specifications and these special provisions.

Padlocks for backflow preventer assembly enclosures, walk gates, and irrigation controller enclosure cabinets.

8-1.03 SLAG AGGREGATE

Air-cooled iron blast furnace slag shall not be used to produce aggregate for:

A. Structure backfill material.
B. Pervious backfill material.
C. Permeable material.
D. Reinforced or prestressed portland cement concrete component or structure.
E. Nonreinforced portland cement concrete component or structure for which a Class 1 Surface Finish is required by the provisions in Section 51-1.18B, "Class 1 Surface Finish," of the Standard Specifications.

Aggregate produced from slag resulting from a steel-making process shall not be used for a highway construction project except for the following items:

A. Imported Borrow.
B. Aggregate Subbase.
C. Class 2 Aggregate Base.
D. Asphalt Concrete.

Steel slag to be used to produce aggregate for aggregate subbase and Class 2 aggregate base shall be crushed so that 100 percent of the material will pass a 3/4-inch sieve and then shall be control aged for a period of at least 3 months under conditions that will maintain all portions of the stockpiled material at a moisture content in excess of 6 percent of the dry weight of the aggregate.

A supplier of steel slag aggregate shall provide separate stockpiles for controlled aging of the slag. An individual stockpile shall contain not less than 10,000 tons nor more than 50,000 tons of slag. The material in each individual stockpile shall be assigned a unique lot number and each stockpile shall be identified with a permanent system of signs. The supplier shall maintain a permanent record of the dates on which stockpiles are completed and controlled aging begun, of the dates when controlled aging was completed, and of the dates tests were made and the results of these tests. Moisture tests shall be made at least once each week. No credit for aging will be given for the time period covered by tests which show a moisture content of 6 percent or less. The stockpiles and records shall be available to the Engineer during normal working hours for inspection, check testing and review.

The supplier shall notify the Transportation Laboratory when each stockpile is completed and controlled aging begun. No more aggregate shall be added to the stockpile unless a new aging period is initiated. A further notification shall be sent when controlled aging is completed.

The supplier shall provide a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Each stockpile or portion of a stockpile that is used in the work will be considered a lot. The Certificates of Compliance shall state that the steel slag aggregate has been aged in a stockpile for at least 3 months at a moisture content in excess of 6 percent of the dry weight of the aggregate.

Steel slag used for imported borrow shall be weathered for at least 3 months. Prior to the use of steel slag as imported borrow, the supplier shall furnish a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Certificate of Compliance shall state that the steel slag has been weathered for at least 3 months.

Each delivery of aggregate containing steel slag for use as aggregate subbase or Class 2 aggregate base shall be accompanied by a delivery tag for each load which will identify the lot of material by stockpile number, where the slag was aged, and the date that the stockpile was completed and controlled aging begun.

Air-cooled iron blast furnace slag or natural aggregate may be blended in proper combinations with steel slag aggregate to produce the specified gradings, for those items for which steel slag aggregate is permitted, unless otherwise provided.

Aggregate containing slag shall meet the applicable quality requirements for the items in which the aggregate is used.

The combined slag aggregate shall conform to the specified grading for the item in which it is used. The grading will be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between the coarse and fine portion of the aggregate or between blends of different aggregates.

No aggregate produced from slag shall be placed within one foot, measured in any direction, of a non-cathodically protected pipe or structure unless the aggregate is incorporated in portland cement concrete pavement, in asphalt concrete, or in treated base.

When slag is used as aggregate in asphalt concrete, the K_c factor requirements, as determined by California Test 303, will not apply.

Slag aggregate used for embankment construction shall not be placed within 18 inches of finished slope lines, measured normal to the plane of the slope.

If steel slag aggregates are used to make asphalt concrete, there shall be no other aggregates used in the mixture, except that up to 50 percent of the material passing the No. 4 sieve may consist of iron blast furnace slag aggregates or natural aggregates, or a combination thereof. If iron blast furnace aggregates or natural aggregates or a combination thereof are used in the mix, each type of aggregate shall be fed to the drier at a uniform rate. The rate of feed of each type of aggregate shall be maintained within 10 percent of the amount set. Adequate means shall be provided for controlling and checking the accuracy of the feeder.

In addition to the requirements of Section 39-3.01, "Storage," of the Standard Specifications, steel slag aggregate shall be stored separately from iron blast furnace slag aggregate and each type of slag aggregate shall also be stored separately from natural aggregate.

Asphalt concrete produced from more than one of the following shall not be placed in the same layer: steel slag aggregates, iron blast furnace slag aggregates, natural aggregates or any combination thereof. Once a type of aggregate or aggregates is selected, it shall not be changed without prior approval by the Engineer.

If steel slag aggregates are used to produce asphalt concrete, and if the specific gravity of a compacted stabilometer test specimen is in excess of 2.40, the quantity of asphalt concrete to be paid for will be reduced. The stabilometer test specimen will be fabricated in conformance with the procedures in California Test 304 and the specific gravity of the specimen will be determined in conformance with Method C of California Test 308. The pay quantity of asphalt concrete will be determined by multiplying the quantity of asphalt concrete placed in the work by 2.40 and dividing the result by the specific gravity of the compacted stabilometer test specimen. Such reduction in quantity will be determined and applied as often as is necessary to ensure accurate results as determined by the Engineer.

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications and these special provisions.

The Department maintains a list of sources of fine and coarse aggregate that have been approved for use with a reduced amount of supplementary cementitious material in the total amount of cementitious material to be used. A source of aggregate will be considered for addition to the approved list if the producer of the aggregate submits to the Transportation Laboratory certified test results from a qualified testing laboratory that verify the aggregate complies with the requirements. Before the testing starts, the aggregate test shall be registered with the Department. A registration number can be obtained by calling (916) 227-7228. The registration number shall be used as the identification for the aggregate sample in correspondence with the Department. Upon request, a split of the tested sample shall be provided to the Department. Approval of aggregate will depend upon compliance with the specifications, based on the certified test results submitted, together with any replicate testing the Department may elect to perform. Approval will expire 3 years from the date the most recent registered and evaluated sample was collected from the aggregate source.

Qualified testing laboratories shall conform to the following requirements:

1. Laboratories performing ASTM Designation: C 1293 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Concrete Proficiency Sample Program and shall have received a score of 3 or better on each test of the previous 2 sets of concrete samples.
2. Laboratories performing ASTM Designation: C 1260 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Pozzolan Proficiency Sample Program and shall have received a score of 3 or better on the shrinkage and soundness tests of the previous 2 sets of pozzolan samples.

Aggregates on the list shall conform to one of the following requirements:

1. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1293, the average expansion at one year shall be less than or equal to 0.040 percent; or
2. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1260, the average of the expansion at 16 days shall be less than or equal to 0.15 percent.

If the aggregates used in the concrete are on the Department's list, the minimum amount of supplementary cementitious material shall conform to the following:

1. If fly ash or natural pozzolan conforming to the provisions in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications is used, the minimum amount of supplementary cementitious material shall be 15 percent by weight of the total cementitious material; or

2. If silica fume conforming to the provisions in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the Standard Specifications is used, the minimum amount of supplementary cementitious material shall be 7 percent by weight of the total cementitious material.

The limitation on tricalcium silicate (C_3S) content in Type II cement specified in Section 90-2.01A, "Cement," of the Standard Specifications shall not apply.

SECTION 8-3. WELDING

8-3.01 WELDING

GENERAL

Flux cored welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.

Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2006
D1.4	2005
D1.5	2002
D1.6	1999

Requirements of the AWS welding codes shall apply unless otherwise specified in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or AASHTO/AWS.

Section 6.1.1.1 of AWS D1.5 is replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing of each weld joint prior to welding, during welding, and after welding as specified in this section and as necessary to ensure that materials and workmanship conform to the requirements of the contract documents.

Unless otherwise specified, Sections 6.1.3 through 6.1.4.3 of AWS D1.1, Section 7.1.2 of AWS D1.4, and Sections 6.1.1.2 through 6.1.3.3 of AWS D1.5 are replaced with the following:

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.

Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors." The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector provided the assistant is always within visible and audible range of the QC Inspector. The QC Inspector shall be responsible for signing all reports and for determining if welded materials conform to workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors shall not exceed 5 to 1.

When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.

When any work is welded in conformance with the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications, not including Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications, Section 6.1.4 of AWS D1.1 is replaced with the following:

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship and shall be currently certified as an AWS CWI in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors," or as a Welding Inspector Specialist (WIS) in conformance with the requirements in AWS B5.2, "Specification for the Qualification of Welding Inspector Specialists and Welding Inspector Assistants."

Section 6.14.6, "Personnel Qualification," of AWS D1.1, Section 7.8, "Personnel Qualification," of AWS D1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports shall be either:

A. Certified NDT Level II technicians, or;
B. Level III technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians.

Section 6.5.4 of AWS D1.5 is replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved Welding Procedure Specification (WPS) are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Sections 3 and 6.26. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities shall be aided by strong light, magnifiers, or such other devices as may be helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

Section 6.6.5, "Nonspecified NDT Other than Visual," of AWS D1.1, Section 7.6.5 of AWS D1.4 and Section 6.6.5 of AWS D1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS or other specified welding codes, in the Standard Specifications, or in these special provisions. Except as provided for in these special provisions, additional NDT required by the Engineer, and associated repair work, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. Prior to release of welded material by the Engineer, if testing by NDT methods other than those originally specified discloses an attempt to defraud or reveals a gross nonconformance, all costs associated with the repair of the deficient area, including NDT of the weld and of the repair, and any delays caused by the repair, shall be at the Contractor’s expense. A gross nonconformance is defined as the sum of planar type rejectable indications in more than 20 percent of the tested length.

When less than 100 percent of NDT is specified for any weld, it is expected that the entire length of weld meet the specified acceptance-rejection criteria. Should any welding deficiencies be discovered by additional NDT directed or performed by the Engineer that utilizes the same NDT method as that originally specified, all costs associated with the repair of the deficient area, including NDT of the weld and of the weld repair, and any delays caused by the repair, shall be at the Contractor's expense.

Repair work to correct welding deficiencies discovered by visual inspection directed or performed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means approved by the Engineer.

Inspection and approval of all joint preparations, assembly practices, joint fit-ups, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day welding is performed. For each inspection, including fit-up, Welding Procedure Specification (WPS) verification, and final weld inspection, the QC Inspector shall confirm and document compliance with the requirements of the AWS or other specified code criteria and the requirements of these special provisions on all welded joints before welding, during welding, and after the completion of each weld.

In addition to the requirements specified in the applicable code, the period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. If welding will be performed without gas shielding, then qualification shall also be without gas shielding. Excluding welding of fracture critical members, a valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's or welding operator's work remains satisfactory.

In addition to the requirements of AWS D1.1, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

A. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.1, Section 4.1.1, shall be consistent for each pass in a weld joint and shall in no case vary by more than ±10 percent for travel speed, ±10 percent for amperage, and ±7 percent for voltage as measured from a predetermined target value or average within each weld pass. The travel speed shall in no case vary by more than ±15 percent when using submerged arc welding.
B. When a nonstandard weld joint is to be made using a combination of WPSs, a single test may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 4.5.

In addition to the requirements of AWS D1.5, Section 5.12 or 5.13, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

A. Unless considered prequalified, fillet welds shall be qualified in each position. The fillet weld soundness test shall be conducted using the essential variables of the WPS as established by the Procedure Qualification Record (PQR).
B. For qualification of joints that do not conform to Figures 2.4 and 2.5 of AWS D1.5, a minimum of two WPS qualification tests are required. The tests shall be conducted using both Figure 5.1 and Figure 5.3. The test conforming to Figure 5.1 shall be conducted in conformance with AWS D1.5, Section 5.12 or 5.13. The test conforming to Figure 5.3 shall be conducted using the welding electrical parameters that were established for the test conducted conforming to Figure 5.1. The ranges of welding electrical parameters established during welding per Figure 5.1 in conformance with AWS D1.5, Section 5.12, shall be further restricted according to the limits in Table 5.3 during welding per Figure 5.3.
C. Multiple zones within a weld joint may be qualified. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.5 Section 5.13 shall be consistent for each pass in a weld joint, and shall in no case vary by more than ±10 percent for travel speed, ±10 percent for amperage, and ±7 percent for voltage as measured from a predetermined target value or average within each weld pass or zone. The travel speed shall in no case vary by more than ±15 percent when using submerged arc welding.
D. For a WPS qualified in conformance with AWS D1.5 Section 5.13, the values to be used for calculating ranges for current and voltage shall be based on the average of all weld passes made in the test. Heat input shall be calculated using the average of current and voltage of all weld passes made in the test for a WPS qualified in conformance with Section 5.12 or 5.13.
E. Macroetch tests are required for WPS qualification tests, and acceptance shall be per AWS D1.5 Section 5.19.3.
F. When a nonstandard weld joint is to be made using a combination of WPSs, a test conforming to Figure 5.3 may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 5.3.
G. Prior to preparing mechanical test specimens, the PQR welds shall be inspected by visual and radiographic tests. Backing bar shall be 3 inches in width and shall remain in place during NDT testing. Results of the visual and radiographic tests shall comply with AWS D1.5 Section 6.26.2, excluding Section 6.26.2.2. Test plates that do not comply with both tests shall not be used.

WELDING FOR POLE STRUCTURES

The Contractor shall meet the following requirements for any work welded in conformance with the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

Welding inspection personnel or NDT firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for when the welding is performed at a permanent fabrication or manufacturing facility which is certified under the AISC Quality Certification Program, Category Sbd, Conventional Steel Building Structures.

Welding Qualification Audit

Contractors or subcontractors performing welding operations for overhead sign and pole structures shall not deliver materials to the project without having successfully completed the Department's "Manufacturing Qualification Audit for Overhead Sign and Pole Structures," hereinafter referred to as the audit, not more than one year prior to the delivery of the materials. The Engineer will perform the audit. Copies of the audit form, and procedures for requesting and completing the audit, are available at the Transportation Laboratory or at:

http://www.dot.ca.gov/hq/esc/Translab/smbresources.htm

An audit that was approved by the Engineer no more than one year prior to the beginning of work on this contract will be acceptable for the entire period of this contract, provided the Engineer determines the audit was for the same type of work that is to be performed on this contract.

Successful completion of an audit shall not relieve the Contractor of the responsibility for furnishing materials or producing finished work of the quality specified in these special provisions and as shown on the plans.

Welding Report

A daily production log for welding shall be kept for each day that welding is performed. The log shall clearly indicate the locations of all welding. The log shall include the welders' names, amount of welding performed, any problems or deficiencies discovered, and any testing or repair work performed, at each location. The daily report from each QC Inspector shall also be included in the log.

A Welding Report shall be submitted to the Engineer 48 hours prior to furnishing a Certificate of Compliance for the material in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. The Welding Report shall include the following items:

A. A daily production log.
B. Reports of all visual weld inspections and NDT.
H. Radiographs and radiographic reports, and other required NDT reports.
I. A summary of welding and NDT activities that occurred during the reporting period.
J. Documentation that the Contractor has evaluated all radiographs and other nondestructive tests and corrected all rejectable deficiencies, and all repaired welds have been reexamined by the required NDT and found acceptable.

PAYMENT

Full compensation for conforming to the requirements of "Welding" shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

SECTION 9. (BLANK)

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the Standard Specifications and these special provisions.

Attention is directed to "Miscellaneous Concrete Construction" of these special provisions regarding constructing a 4' x 6' test panel prior to placing the colored sidewalk.

Attention is directed to "Miscellaneous Concrete Construction" of these special provisions regarding constructing a 2' x 2' test panel prior to constructing curb ramps with detectable warning surfaces.

Temporary crash cushions shall be secured in place prior to commencing work for which the temporary crash cushions are required.

Attention is directed to "Water Pollution Control" of these special provisions regarding the submittal and approval of the "Storm Water Pollution Prevention Plan" prior to performing work having potential to cause water pollution.

Attention is directed to "Maintaining Traffic" of these special provisions.

Attention is directed to "Progress Schedule (Critical Path Method)" of these special provisions regarding the submittal of a general time-scaled logic diagram within 10 days after approval of the contract. The diagram shall be submitted prior to performing any work that may be affected by any proposed deviations to the construction staging of the project.

Prior to applying paint binder (tack coat), the Contractor shall cover all manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured to the facility being covered by tape or adhesive. The covered facilities shall be referenced by the Contractor, with a sufficient number of control points to relocate the facilities after the asphalt concrete (type A) has been placed. After completion of the asphalt concrete paving operation, all covers shall be removed and disposed of in a manner satisfactory to the Engineer. Full compensation for covering manholes, valve and monument covers, grates, or other exposed facilities, referencing, and removing temporary cover shall be considered as included in the contract price paid per ton for asphalt concrete (type A), and no additional compensation will be allowed therefor.

At least 60 days before planting the plants, furnish the Engineer a statement from the vendor that the order for the plants required for this contract, including inspection plants, has been received and accepted by the vendor. The statement from the vendor must include the names, sizes, and quantities of plants ordered and the anticipated date of delivery.

Place orders for replacement plants with the vendor at the appropriate time so that the roots of the replacement plants are not in a root-bound condition.

At least 60 days before applying seeds, furnish the Engineer a statement from the vendor that the order for the seed required for this contract has been received and accepted by the vendor. The statement from the vendor must include the names and quantity of seed ordered and the anticipated date of delivery.

Unless otherwise shown on the plans or specified in these special provisions, irrigation sleeves to be installed by the open trench method for water line crossovers and sprinkler control crossovers must be installed before the installation of other pipe supply lines.

Submittal of working drawings for electrical components must comply with Section 20-5.027B, "Wiring Plans and Diagrams," of the Standard Specifications.

Preinstall irrigation components in the irrigation controller enclosure cabinet before field installation as specified under "Irrigation Controller Enclosure Cabinet" of these special provisions.

10-1.02 WATER POLLUTION CONTROL

GENERAL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications, section of these special provisions entitled "Relations With California Regional Water Quality Control Board," and these special provisions.

A Storm Water Information Handout has been prepared for this contract and is available as described in "Project Information" of these special provisions.

The Contractor may obtain other National Pollutant Discharge Elimination System (NPDES) permits that apply to activities and mobile operations within or outside of the project limits including asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards, or access roads.

The Contractor shall perform water pollution control work in conformance with the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and its addenda in effect on the day the Notice to Contractors is dated. This manual is referred to as the "Preparation Manual." Copies of the Preparation Manual may be obtained from:

State of California
Department of Transportation
Publication Distribution Unit
1900 Royal Oaks Drive
Sacramento, California 95815
Telephone: (916) 445-3520

The Preparation Manual and other references for performing water pollution control work are available from the Department's Construction Storm Water and Water Pollution Control web site at:

http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

Before the start of job site activities, the Contractor shall provide training for project managers, supervisory personnel, and employees involved with water pollution control work. The training shall include:

A. Rules and regulations
B. Implementation and maintenance for:

    1. Temporary Soil Stabilization
    2. Temporary Sediment Control
    3. Tracking Control
    4. Wind Erosion Control

The Contractor shall designate in writing a Water Pollution Control Manager (WPCM). The Contractor shall submit a statement of qualifications describing the training, work history, and expertise of the proposed WPCM. The qualifications shall include either:

A. A minimum of 24 hours of Department approved storm water management training described at Department's Construction Storm Water and Water Pollution Control web site.
B. Certification as a Certified Professional in Erosion and Sediment Control (CPESC).

The WPCM shall be:

A. Responsible for water pollution control work.
B. The primary contact for water pollution control work.
C. Have authority to mobilize crews to make immediate repairs to water pollution control practices.

The Contractor may designate one manager to prepare the SWPPP and a different manager to implement the plan. The WPCP preparer shall meet the training requirements for the WPCM.

STORM WATER POLLUTION PREVENTION PLAN

The Contractor shall submit a Storm Water Pollution Prevention Plan (SWPPP) to the Engineer for approval. The SWPPP shall conform to the requirements in the Preparation Manual, the NPDES permit, and these special provisions. The SWPPP shall be submitted in place of the water pollution control program required by the provisions in Section 7-1.01G, "Water Pollution," of the Standard Specifications.

The SWPPP shall include water pollution control practices:

A. For storm water and non-storm water from areas outside of the job site related to construction activities for this contract such as:

    1. Staging areas.
    2. Storage yards.
    3. Access roads.

B. Appropriate for each season as described in "Implementation Requirements" of these special provisions.
C. For activities or mobile operations related to all NPDES permits.

The SWPPP shall include a schedule that:

A. Describes when work activities that could cause water pollution will be performed.
B. Identifies soil stabilization and sediment control practices for disturbed soil area.
C. Includes dates when these practices will be 25, 50, and 100 percent complete.
D. Shows 100 percent completion of these practices before the rainy season.

The SWPPP shall include the following temporary water pollution control practices and their associated contract items of work as shown on the plans or specified in these special provisions:

A. Temporary Soil Stabilization

    1. Temporary Fiber Roll

B. Temporary Sediment Control

    1. Temporary Gravel Bag Berm
    2. Street Sweeping
    3. Temporary Drainage Inlet Protection

C. Tracking Control

    1. Stabilized Temporary Construction Entrance

C. Waste Management and Materials Pollution Control

    1. Temporary Concrete Washout Facility

The SWPPP shall include the following contract items of work for permanent water pollution control as shown on the plans or as specified in these special provisions:

A. Erosion Control (Type D)
B. Site Grading
C. 24" Corrugated Steel Pipe Riser
D. 24" Corrugated Steel Pipe Riser Inlet

Within 20 days after contract approval, the Contractor shall submit 3 copies of the SWPPP to the Engineer. The Contractor shall allow 20 days for the Engineer's review. If revisions are required, the Engineer will provide comments and specify the date that the review stopped. The Contractor shall revise and resubmit the SWPPP within 15 days of receipt of the Engineer's comments. The Engineer's review will resume when the complete SWPPP is resubmitted. When the Engineer approves the SWPPP, the Contractor shall submit 4 copies of the approved SWPPP to the Engineer. The Contractor may proceed with construction activities if the Engineer conditionally approves the SWPPP while minor revisions are being completed. If the Engineer fails to complete the review within the time allowed and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay, the Contractor will be compensated for resulting losses, and an extension of time will be granted, as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

The Contractor shall not perform work that may cause water pollution until the SWPPP has been approved by the Engineer. The Engineer's review and approval shall not waive any contract requirements and shall not relieve the Contractor from complying with Federal, State and local laws, regulations, and requirements.

The Contractor shall amend the SWPPP annually and shall resubmit it to the Engineer 25 days before the defined rainy season.

If there is a change in construction schedule or activities, the Contractor shall prepare an amendment to the SWPPP to identify additional or revised water pollution control practices. The Contractor shall submit the amendment to the Engineer for review within a time agreed to by the Engineer not to exceed the number of days specified for the initial submittal of the SWPPP. The Engineer will review the amendment within the same time allotted for the review of the initial submittal of the SWPPP.

If directed by the Engineer or requested in writing by the Contractor and approved by the Engineer, changes to the water pollution control work specified in these special provisions will be allowed. Changes may include addition of new water pollution control practices. The Contractor shall incorporate these changes in the SWPPP. Additional water pollution control work will be paid for as extra work in accordance with Section 4-1.03, "Extra work," of the Standard Specifications.

The Contractor shall keep a copy of the approved SWPPP at the job site. The SWPPP shall be made available when requested by a representative of the Regional Water Quality Control Board, State Water Resources Control Board, United States Environmental Protection Agency, or the local storm water management agency. Requests from the public shall be directed to the Engineer.

SAMPLING AND ANALYSIS

The Contractor shall include a Sampling and Analysis Plan (SAP) in the SWPPP to monitor the effectiveness of the water pollution control practices. The Contractor shall prepare the SAP in conformance with the Preparation Manual.

The Contractor shall designate trained personnel to collect water quality samples. The personnel and training shall be documented in the SAP. Training shall consist of the following elements:

A. SAP review,
B. Health and safety review, and
C. Sampling simulations.

In the SAP the Contractor shall describe the following water quality sampling procedures:

A. Sampling preparation,
B. Collection,
C. Quality assurance and quality control,
D. Sample labeling,
E. Collection documentation,
F. Sample shipping,
G. Chain of custody,
H. Sample numbering, and
I. Precautions from the construction site health and safety plan.

The Contractor shall document sample collection during precipitation.

Samples to be analyzed in the field shall be taken by the Contractor's designated sampling personnel using collection and analysis methods, and equipment calibration specified by the manufacturer of the sampling equipment. Samples to be analyzed by a laboratory, shall be sampled, preserved, and analyzed by a State-certified laboratory in conformance with the requirements in 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants." The Contractor shall identify the State-certified laboratory, sample containers, preservation requirements, holding times, and analysis method in the SAP. A list of State-certified laboratories that are approved by the Department is available at:

http://www.dhs.ca.gov/ps/ls/ELAP/html/lablist.htm

Non-Visible Pollutants

This project has the potential to discharge non-visible pollutants in storm water from the construction site. The Contractor shall include in the SAP a description of the sampling and analysis strategy to be implemented on the project for monitoring non-visible pollutants.

In the SAP the Contractor shall identify potential non-visible pollutants that will be present on the construction site associated with the following:

A. Construction materials and wastes;
B. Existing contamination due to historical site usage; or
C. Application of soil amendments, including soil stabilization products, with the potential to alter pH or contribute toxic pollutants to storm water.

The Contractor shall show the locations planned for storage and use of the potential non-visible pollutants on the SWPPP Water Pollution Control Drawings.

The Contractor shall include in the SAP the following list of conditions that require sampling when observed during a storm water inspection:

A. Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions.
B. Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but:

    1. A breach, leakage, malfunction, or spill is observed;
    2. The leak or spill has not been cleaned up before precipitation; and
    3. There is the potential for discharge of non-visible pollutants to surface waters or drainage system.

C. Construction activities; such as application of fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound; have occurred during precipitation or within 24 hours preceding precipitation, and have the potential to discharge pollutants to surface waters or drainage system.
D. Soil amendments, including soil stabilization products, with the potential to alter pH levels or contribute toxic pollutants to storm water runoff have been applied, and have the potential to discharge pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentrations of non-visible pollutants in the soil amendment).
E. Storm water runoff from an area contaminated by historical usage of the site has the potential to discharge pollutants to surface waters or drainage system.

The Contractor shall describe in the SAP the schedule for collecting a sample downhill from each non-visible pollutant source and an uncontaminated control sample, during the first 2 hours of discharge from precipitation during daylight hours that result in enough discharge for sample collection. If discharge flows to the non-visible pollutant source, a sample shall be collected immediately downhill from where the discharge enters the Department's right of way. If precipitation occurs again after at least 72 hours of dry weather the Contractor shall take new samples.

In the SAP the Contractor shall identify sampling locations for collecting downstream and control samples, and the reason for their selection. The control sampling location shall be selected so the sample does not come into contact with materials, wastes or areas associated with potential non-visible pollutants or disturbed soil areas. The Contractor shall show non-visible pollutant sampling locations on the SWPPP Water Pollution Control Drawings.

The Contractor shall identify in the SAP the analytical method to be used for downhill and control samples for potential non-visible pollutants on the project.

Analytical Results and Evaluation

The Contractor shall submit a hard copy and electronic copy of water quality analytical results, and quality assurance and quality control data to the Engineer within 5 days of sampling for field analyses, and within 30 days for laboratory analyses. The Contractor shall also provide an evaluation of whether the downhill samples show levels of the tested parameter higher than in the control sample. If downhill or downstream samples show increased levels, the Contractor will assess the water pollution control measures, site conditions, and surrounding influences to determine the probable cause for the increase. As determined by the assessment, the Contractor will repair or modify water pollution control measures to address increases and amend the SWPPP as necessary. Electronic results (in one of the following file formats: .xls, .txt, .csv, .dbs, or .mdb) shall have the following information:

A. Sample identification number.
B. Contract number.
C. Constituent.
D. Reported value.
E. Analytical method.
F. Method detection limit.
G. Reported limit.

The Contractor shall maintain the water quality sampling documentation and analytical results with the SWPPP on the project site.

If construction activities or knowledge of site conditions change such that discharges or sampling locations change, the Contractor shall amend the SAP in conformance with this section, "Water Pollution Control."

IMPLEMENTATION REQUIREMENTS

The Contractor's responsibility for SWPPP implementation shall continue throughout any temporary suspension of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications.

If the Contractor or the Engineer identifies a deficiency in the implementation of the approved SWPPP, the deficiency shall be corrected immediately, unless an agreed date for correction is approved in writing by the Engineer. The deficiency shall be corrected before the onset of precipitation. If the Contractor fails to correct the deficiency by the agreed date or before the onset of precipitation, the Department may correct the deficiency and deduct the cost of correcting deficiencies from payments.

If the Contractor fails to conform to the provisions of this section, "Water Pollution Control," the Engineer may order the suspension of work until the project complies with the requirements of this section.

The Contractor shall construct permanent water pollution control items identified in the SWPPP as specified in "Order of Work" of these special provisions. The Contractor shall maintain the permanent water pollution control items in the locations and condition shown on the plans throughout the duration of the project.

Year-Round

The Contractor shall monitor the National Weather Service weather forecast on a daily basis during the contract. The Contractor may use an alternative weather forecasting service if approved by the Engineer. Appropriate water pollution control practices shall be in place before precipitation.

The Contractor may discontinue earthwork operations for a disturbed area for up to 21 days and the disturbed soil area will still be considered active. When earthwork operations in the disturbed area have been completed, the Contractor shall implement appropriate water pollution control practices within 15 days, or before predicted precipitation, whichever occurs first.

The Contractor shall provide soil stabilization and sediment control practices during the rainy season between October 1 and May 1.

The Contractor shall implement soil stabilization and sediment control practices a minimum of 10 days before the start of the rainy season.

During the defined rainy season, the active disturbed soil area of the project site shall be not more than 5 acres. The Engineer may approve expansions of the active disturbed soil area limit if requested in writing. The Contractor shall maintain soil stabilization and sediment control materials on site to protect disturbed soil areas.

INSPECTION AND MAINTENANCE

The WPCM shall inspect the water pollution control practices identified in the SWPPP as follows:

A. Before a forecasted storm,
B. After precipitation that causes site runoff,
C. At 24-hour intervals during extended precipitation,
D. On a predetermined schedule, a minimum of once every 2 weeks outside of the defined rainy season, and
E. On a predetermined schedule, a minimum of once a week during the defined rainy season.

The WPCM shall oversee the maintenance of the water pollution control practices.

The WPCM shall use the Storm Water Quality Construction Site Inspection Checklist provided in the Preparation Manual or an alternative inspection checklist provided by the Engineer. A copy of the completed site inspection checklist shall be submitted to the Engineer within 24 hours of finishing the inspection.

The Contractor may request approval from the Engineer to suspend inspections of water pollution control practices after work except plant establishment is complete. The Engineer's approval is contingent on approval from the Regional Water Quality Control Board. The Contractor shall not suspend inspections until written approval from the Engineer is received.

REPORTING REQUIREMENTS

If the Contractor identifies discharges into surface waters or drainage systems causing or potentially causing pollution, or if the project receives a written notice or order from a regulatory agency, the Contractor shall immediately inform the Engineer. The Contractor shall submit a written report to the Engineer within 7 days of the discharge, notice or order. The report shall include the following information:

A. The date, time, location, and nature of the operation, type of discharge and quantity, and the cause of the notice or order.
B. The water pollution control practices used before the discharge, or before receiving the notice or order.
C. The date of placement and type of additional or altered water pollution control practices placed after the discharge, or after receiving the notice or order.
D. A maintenance schedule for affected water pollution control practices.

Annual Certifications

By June 15 of each year, the Contractor shall complete and submit to the Engineer an Annual Certification of Compliance, as contained in the Preparation Manual.

PAYMENT

During each estimate period the Contractor fails to conform to the provisions in this section, "Water Pollution Control," or fails to implement the water pollution control practices shown on the plans or specified elsewhere in these special provisions as items of work, the Department will withhold 25 percent of the progress payment.

Withholds for failure to perform water pollution control work will be in addition to all other withholds provided for in the contract. The Department will return performance-failure withholds in the progress payment following the correction of noncompliance.

The contract lump sum price paid for prepare storm water pollution prevention plan shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in preparing, obtaining approval of, and amending the SWPPP, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for prepare storm water pollution prevention plan will be made as follows:

A. After the SWPPP has been approved by the Engineer, 50 percent of the contract item price for prepare storm water pollution prevention plan will be included in the monthly progress estimate.
B. Forty percent of the contract item price for prepare storm water pollution prevention plan will be paid over the life of the contract.
C. After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the Standard Specifications, payment for the remaining 10 percent of the contract item price for prepare storm water pollution prevention plan will be made in conformance with the provisions in Section 9-1.07A, "Payment Prior to Proposed Final Estimate."

Storm water sampling and analysis will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications. No payment will be made for the preparation, collection, analysis, and reporting of storm water samples where appropriate water pollution control practices are not implemented before precipitation or if a failure of a water pollution control practice is not corrected before precipitation.

Implementation of water pollution control practices in areas outside the highway right of way not specifically provided for in the SWPPP or in these special provisions will not be paid for.

Water pollution control practices for which there are separate contract items of work will be measured and paid for as those contract items of work.

10-1.03 CONSTRUCTION SITE MANAGEMENT

Construction site management shall consist of controlling potential sources of water pollution before they come in contact with storm water systems or watercourses. The Contractor shall control material pollution and manage waste and non-storm water existing at the construction site by implementing effective handling, storage, use, and disposal practices.

Attention is directed to "Water Pollution Control" of these special provisions regarding the Contractor's appointment of a water pollution control manager (WPCM) for the project.

The Contractor shall train all employees and subcontractors regarding:

A. Material pollution prevention and control;
B. Waste management;
C. Non-storm water management;
D. Identifying and handling hazardous substances; and
E. Potential dangers to humans and the environment from spills and leaks or exposure to toxic or hazardous substances.

Training shall take place before starting work on this project. New employees shall receive the complete training before starting work on this project. The Contractor shall have regular meetings to discuss and reinforce spill prevention and control; material delivery, storage, use, and disposal; waste management; and non-storm water management procedures.

Instructions for material and waste handling, storage, and spill reporting and cleanup shall be posted at all times in an open, conspicuous, and accessible location at the construction site.

Nonhazardous construction site waste and excess material shall be recycled when practical or disposed of in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications, unless otherwise specified.

Vehicles and equipment at the construction site shall be inspected by the WPCM on a frequent, predetermined schedule, and by the operator each day of use. Leaks shall be repaired immediately, or the vehicle or equipment shall be removed from the construction site.

SPILL PREVENTION AND CONTROL

The Contractor shall implement spill and leak prevention procedures when chemicals or hazardous substances are stored. Spills of petroleum products; substances listed under CFR Title 40, Parts 110, 117, and 302; and sanitary and septic waste shall be contained and cleaned up as soon as is safe.

Minor spills involve small quantities of oil, gasoline, paint, or other material that can be controlled by the first responder upon discovery of the spill. Cleanup of minor spills includes:

A. Containing the spread of the spill,
B. Recovering the spilled material using absorption,
C. Cleaning the contaminated area, and
D. Disposing of contaminated material promptly and properly.

Semi-significant spills are those that can be controlled by the first responder with the help of other personnel. Cleanup of semi-significant spills shall be immediate. Cleanup of semi-significant spills includes:

A. Containing the spread of the spill;
B. Recovering the spilled material using absorption if the spill occurs on paved or an impermeable surface;
C. Containing the spill with an earthen dike and digging up contaminated soil for disposal if the spill occurs on dirt;
D. Covering the spill with plastic or other material to prevent contaminating runoff if the spill occurs during precipitation; and
E. Disposing of contaminated material promptly and properly.

Significant or hazardous spills are those that cannot be controlled by construction personnel. Notifications of these spills shall be immediate. The following steps shall be taken:

A. Construction personnel shall not attempt to cleanup the spill until qualified staff have arrived;
B. Notify the Engineer and follow up with a written report;
C. Obtain the services of a spills contractor or hazardous material team immediately;
D. Notify the local emergency response team by dialing 911 and county officials at the emergency phone numbers kept on the construction site;
E. Notify the Governor's Office of Emergency Services Warning Center at (805) 852-7550;
F. Notify the National Response Center at (800) 424-8802 regarding spills of Federal reportable quantities in conformance with CFR Title 40, Parts 110, 119, and 302;
G. Notify other agencies as appropriate, including:

1. Fire Department,
2. Public Works Department,
3. Coast Guard,
4. Highway Patrol,
5. City Police or County Sheriff Department,
6 Department of Toxic Substances,
7. California Division of Oil and Gas,
8. Cal OSHA, or
9. Regional Water Resources Control Board.

The WPCM shall oversee and enforce proper spill prevention and control measures. Minor, semi-significant, and significant spills shall be reported to the Contractor's WPCM who shall notify the Engineer immediately.

The Contractor shall prevent spills from entering storm water runoff before and during cleanup. Spills shall not be buried or washed with water.

The Contractor shall keep material or waste storage areas clean, well organized, and equipped with enough cleanup supplies for the material being stored. Plastic shall be placed under paving equipment when not in use to catch drips.

MATERIAL MANAGEMENT

Material shall be delivered, used, and stored for this contract in a manner that minimizes or eliminates discharge of material into the air, storm drain systems, or watercourses.

The Contractor shall implement the practices described in this section when taking delivery of, using, or storing the following materials:

A. Hazardous chemicals including:

1. Acids,
2. Lime,
3. Glues,
4. Adhesives,
5. Paints,
6. Solvents, and
7. Curing compounds;

B. Soil stabilizers and binders;
C. Fertilizers;
D. Detergents;
E. Plaster;
F. Petroleum products including:

1. Fuel,
2. Oil, and
3. Grease;

G. Asphalt components and concrete components; and
H. Pesticides and herbicides.

The Contractor shall supply the Material Safety Data Sheet to the Engineer for material used or stored. The Contractor shall keep an accurate inventory of material delivered and stored at the construction site.

Employees trained in emergency spill cleanup procedures shall be present when hazardous materials or chemicals are unloaded.

The Contractor shall use recycled or less hazardous products when practical.

Material Storage

The Contractor shall store liquids, petroleum products, and substances listed in CFR Title 40, Parts 110, 117, and 302 in containers or drums approved by the United States Environmental Protection Agency, and place them in secondary containment facilities.

Secondary containment facilities shall be impervious to the materials stored there for a minimum contact time of 72 hours.

Throughout the rainy season secondary containment facilities shall be covered during non-working days and when precipitation is predicted. Secondary containment facilities shall be adequately ventilated.

The Contractor shall keep the secondary containment facility free of accumulated rainwater or spills. After precipitation, or in the event of spills or leaks, accumulated liquid shall be collected and placed into drums within 24 hours. These liquids shall be handled as hazardous waste in accordance with the provisions in "Hazardous Waste" of these special provisions, unless testing determines them to be nonhazardous.

Incompatible materials, such as chlorine and ammonia, shall not be stored in the same secondary containment facility.

Materials shall be stored in the original containers with the original product labels maintained in legible condition. Damaged or illegible labels shall be replaced immediately.

The secondary containment facility shall have the capacity to contain precipitation from a 24-hour-long, 25-year storm; and 10 percent of the aggregate volume of all containers, or all of the volume of the largest container within the facility, whichever is greater.

The Contractor shall store bagged or boxed material on pallets. Throughout the rainy season, bagged or boxed material shall be protected from wind and rain during non-working days and when precipitation is predicted.

The Contractor shall provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas shall be kept clean, well organized, and equipped with cleanup supplies appropriate for the materials being stored.

The Contractor shall repair or replace perimeter controls, containment structures, covers, and liners as needed. Storage areas shall be inspected before and after precipitation, and at least weekly during other times.

Stockpile Management

The Contractor shall reduce or eliminate potential air and water pollution from stockpiled material including soil, paving material, or pressure treated wood. Stockpiles shall be located out of floodplains when possible, and at least 50 feet from concentrated flows of storm water, drainage courses, or inlets unless written approval is obtained from the Engineer.

The Contractor may discontinue adding or removing material for up to 21 days and a stockpile will still be considered active.

The Contractor shall protect active stockpiles with plastic or geotextile cover, soil stabilization measures, or with linear sediment barrier when precipitation is predicted. Active stockpiles of cold mix asphalt concrete shall be placed on an impervious surface and covered with plastic when precipitation is predicted.

The Contractor shall protect inactive soil stockpiles with a plastic or geotextile cover, or with soil stabilization measures at all times during the rainy season. A linear sediment barrier around the perimeter of the stockpile shall also be used. During the non-rainy season soil stockpiles shall be covered and protected with a linear sediment barrier when precipitation is predicted. The Contractor shall control wind erosion during dry weather as provided in Section 10, "Dust Control," of the Standard Specifications.

Stockpiles of portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate subbase shall be covered with plastic or geotextile, or protected with a linear sediment barrier at all times during the rainy season, and when precipitation is predicted during the non-rainy season.

Stockpiles of cold mix asphalt concrete shall be placed on and covered with impermeable material at all times during the rainy season, and when precipitation is predicted during the non-rainy season.

Stockpiles of pressure treated wood shall be covered with impermeable material and placed on pallets at all times during the rainy season, and when precipitation is predicted during the non-rainy season.

The Contractor shall repair or replace linear sediment barriers and covers as needed or as directed by the Engineer to keep them functioning properly. Sediment shall be removed when it accumulates to 1/3 of the linear sediment barrier height.

WASTE MANAGEMENT

Solid Waste

The Contractor shall not allow litter or debris to accumulate anywhere on the construction site, including storm drain grates, trash racks, and ditch lines. The Contractor shall pick up and remove trash and debris from the construction site at least once a week. The WPCM shall monitor solid waste storage and disposal procedures on the construction site. The Contractor shall provide enough dumpsters of sufficient size to contain the solid waste generated by the project. Dumpsters shall be emptied when refuse reaches the fill line. Dumpsters shall be watertight. The Contractor shall not wash out dumpsters on the construction site. The Contractor shall provide additional containers and more frequent pickup during the demolition phase of construction

Solid waste includes:

A. Brick,
B. Mortar,
C. Timber,
D. Metal scraps,
E. Sawdust,
F. Pipe,
G. Electrical cuttings,
H. Non-hazardous equipment parts,
I. Styrofoam and other packaging materials,
J. Vegetative material and plant containers from highway planting, and
K. Litter and smoking material, including litter generated randomly by the public.

Trash receptacles shall be provided and used in the Contractor's yard, field trailers, and locations where workers gather for lunch and breaks.

Hazardous Waste

The Contractor shall implement hazardous waste management practices when waste is generated on the construction site from the following substances:

A. Petroleum products,
B. Asphalt products,
C. Concrete curing compound,
D. Pesticides,
E. Acids,
F. Paints,
G. Stains,
H. Solvents,
I. Wood preservatives,
J. Roofing tar, and
K. Materials classified as hazardous by California Code of Regulations, Title 22, Division 4.5; or listed in CFR Title 40, Parts 110, 117, 261, or 302.

Nothing in these special provisions shall relieve the Contractor of the responsibility for compliance with Federal, State, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.

The WPCM shall oversee and enforce hazardous waste management practices. Production of hazardous materials and hazardous waste on the construction site shall be kept to a minimum. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced when damaged.

The Contractor shall have a laboratory certified by the Department of Health Services (DHS) sample and test waste when hazardous material levels are unknown to determine safe methods for storage and disposal.

The Contractor shall segregate potentially hazardous waste from nonhazardous waste at the construction site. Hazardous waste shall be handled, stored, and disposed of as required in California Code of Regulations, Title 22, Division 4.5, Section 66262.34; and in CFR Title 49, Parts 261, 262, and 263.

The Contractor shall store hazardous waste in sealed containers constructed and labeled with the contents and date accumulated as required in California Code of Regulations, Title 22, Division 4.5; and in CFR Title 49, Parts 172, 173, 178, and 179. Hazardous waste containers shall be kept in temporary containment facilities conforming to the provisions in "Material Storage" of these special provisions.

There shall be adequate storage volume and containers shall be conveniently located for hazardous waste collection. Containers of hazardous waste shall not be overfilled and hazardous wastes shall not be mixed. Containers of dry waste that are not watertight shall be stored on pallets. The Contractor shall not allow potentially hazardous waste to accumulate on the ground. Hazardous waste shall be stored away from storm drains, watercourses, moving vehicles, and equipment.

The Contractor shall clean water based or oil based paint from brushes or equipment within a contained area and shall not contaminate soil, watercourses, or storm drain systems. Paints, thinners, solvents, residues, and sludges that cannot be recycled or reused shall be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths shall be disposed of as solid waste.

The Contractor shall dispose of hazardous waste within 90 days of being generated. Hazardous waste shall be disposed of by a licensed hazardous waste transporter using uniform hazardous waste manifest forms and taken to a Class I Disposal Site. A copy of the manifest shall be provided to the Engineer.

Contaminated Soil

The Contractor shall identify contaminated soil from spills or leaks by noticing discoloration, odors, or differences in soil properties. Soil with evidence of contamination shall be sampled and tested by a laboratory certified by DHS. If levels of contamination are found to be hazardous, the soil shall be handled and disposed of as hazardous waste.

The Contractor shall prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:

A. Berms,
B. Cofferdams,
C. Grout curtains,
D. Freeze walls, or
E. Concrete seal course.

If water mixes with contaminated soil and becomes contaminated, the water shall be sampled and tested by a laboratory certified by the DHS. If levels of contamination are found to be hazardous, the water shall be handled and disposed of as hazardous waste.

Concrete Waste

The Contractor shall implement practices to prevent the discharge of portland cement concrete or asphalt concrete waste into storm drain systems or watercourses.

Portland cement concrete or asphalt concrete waste shall be collected at the following locations and disposed of:

A. Where concrete material, including grout, is used;
B. Where concrete dust and debris result from demolition;
C. Where sawcutting, coring, grinding, grooving, or hydro-concrete demolition of portland cement concrete or asphalt concrete creates a residue or slurry; or
D. Where concrete trucks or other concrete-coated equipment is cleaned at the construction site.

Sanitary and Septic Waste

Wastewater from sanitary or septic systems shall not be discharged or buried within the Department right of way. The WPCM shall inspect sanitary or septic waste storage and monitor disposal procedures at least weekly. Sanitary facilities that discharge to the sanitary sewer system shall be properly connected and free from leaks.

The Contractor shall obtain written approval from the local health agency, city, county, and sewer district before discharging from a sanitary or septic system directly into a sanitary sewer system, and provide a copy to the Engineer. The Contractor shall comply with local health agency requirements when using an on-site disposal system.

Liquid Waste

The Contractor shall not allow construction site liquid waste, including the following, to enter storm drain systems or watercourses:

A. Drilling slurries or fluids,
B. Grease-free or oil-free wastewater or rinse water,
C. Dredgings,
D. Liquid waste running off a surface including wash or rinse water, or
E. Other non-storm water liquids not covered by separate permits.

The Contractor shall hold liquid waste in structurally sound, leak proof containers such as:

A. Sediment traps,
B. Roll-off bins, or
C. Portable tanks.

Liquid waste containers shall be of sufficient quantity and volume to prevent spills and leaks. The containers shall be stored at least 50 feet from storm drains, watercourses, moving vehicles, and equipment.

The Contractor shall remove and dispose of deposited solids from sediment traps as provided in "Solid Waste" of these special provisions, unless determined infeasible by the Engineer.

Liquid waste may require testing to determine hazardous material content before disposal.

Drilling fluids and residue shall be disposed of outside the highway right of way. If the Engineer determines that an appropriate location is available, fluids and residue exempt under California Code of Regulations, Title 23, Section 2511(g) may be dried by infiltration and evaporation in a leak proof container. The remaining solid waste may be disposed of as provided in "Solid Waste" of these special provisions.

NON-STORM WATER MANAGEMENT

Water Control and Conservation

The Contractor shall prevent erosion or the discharge of pollutants into storm drain systems or watercourses by managing the water used for construction operations. The Contractor shall obtain the Engineer's approval before washing anything on the construction site with water that could discharge into a storm drain system or watercourse. Discharges shall be reported to the Engineer immediately.

The Contractor shall implement water conservation practices when water is used on the construction site. Irrigation areas shall be inspected and watering schedules shall be adjusted to prevent erosion, excess watering, or runoff. The Contractor shall shut off the water source to broken lines, sprinklers, or valves, and they shall be repaired as soon as possible. When possible, water from waterline flushing shall be reused for landscape irrigation. Paved areas shall be swept and vacuumed, not washed with water.

Construction water runoff, including water from water line repair, shall be directed to areas to infiltrate into the ground and shall not be allowed to enter storm drain systems or watercourses. Spilled water shall not be allowed to escape water truck filling areas. When possible, the Contractor shall direct water from off-site sources around the construction site, or shall minimize contact with the construction site.

Illegal Connection and Discharge Detection and Reporting

The Contractor shall inspect the construction site and the site perimeter before beginning work for evidence of illegal connections, discharges, or dumping. Subsequently, the construction site and perimeter shall be inspected on a frequent, predetermined schedule.

The Contractor shall immediately notify the Engineer when illegal connections, discharges, or dumping are discovered. The Contractor shall take no further action unless directed by the Engineer. Unlabeled or unidentifiable material shall be assumed to be hazardous.

The Contractor shall look for the following evidence of illegal connections, discharges, or dumping:

A. Debris or trash piles,
B. Staining or discoloration on pavement or soils,
C. Pungent odors coming from drainage systems,
D. Discoloration or oily sheen on water,
E. Stains or residue in ditches, channels or drain boxes,
F. Abnormal water flow during dry weather,
G. Excessive sediment deposits,
H. Nonstandard drainage junction structures, or
I. Broken concrete or other disturbances near junction structures.

Vehicle and Equipment Cleaning

The Contractor shall limit vehicle and equipment cleaning or washing on the construction site to that necessary to control vehicle tracking or hazardous waste. Vehicles and equipment shall not be cleaned on the construction site with soap, solvents, or steam until the Engineer has been notified. The resulting waste shall be contained and recycled, or disposed of as provided in "Liquid Waste" or "Hazardous Waste" of these special provisions, whichever is applicable. The Contractor shall not use diesel to clean vehicles or equipment, and shall minimize the use of solvents.

The Contractor shall clean or wash vehicles and equipment in a structure equipped with disposal facilities. If using a structure is not possible, vehicles and equipment shall be cleaned or washed in an outside area with the following characteristics:

A. Located at least 50 feet from storm drainage systems or watercourses,
B. Paved with asphalt concrete or portland cement concrete,
C. Surrounded by a containment berm, and
D. Equipped with a sump to collect and dispose of wash water.

When washing vehicles or equipment with water, the Contractor shall use as little water as possible. Hoses shall be equipped with a positive shutoff valve.

Wash racks shall discharge to a recycle system or to another system approved by the Engineer. Sumps shall be inspected regularly, and liquids and sediments shall be removed as needed.

Vehicle and Equipment Fueling and Maintenance

The Contractor shall fuel or perform maintenance on vehicles and equipment off the construction site whenever practical. When fueling or maintenance must be done at the construction site, the Contractor shall designate a site, or sites, and obtain approval from the Engineer before using. The fueling or maintenance site shall be protected from storm water, shall be on level ground, and shall be located at least 50 feet from drainage inlets or watercourses. The WPCM shall inspect the fueling or maintenance site regularly. Mobile fueling or maintenance shall be kept to a minimum.

The Contractor shall use containment berms or dikes around the fueling and maintenance area. Adequate amounts of absorbent spill cleanup material and spill kits shall be kept in the fueling and maintenance area and on fueling trucks. Spill cleanup material and kits shall be disposed of immediately after use. Drip pans or absorbent pads shall be used during fueling or maintenance unless performed over an impermeable surface.

Fueling or maintenance operations shall not be left unattended. Fueling nozzles shall be equipped with an automatic shutoff control. Vapor recovery fueling nozzles shall be used where required by the Air Quality Management District. Nozzles shall be secured upright when not in use. Fuel tanks shall not be topped-off.

The Contractor shall recycle or properly dispose of used batteries and tires.

Material and Equipment Used Over Water

Drip pans and absorbent pads shall be placed under vehicles or equipment used over water, and an adequate supply of spill cleanup material shall be kept with the vehicle or equipment. Drip pans or plastic sheeting shall be placed under vehicles or equipment on docks, barges, or other surfaces over water when the vehicle or equipment will be idle for more than one hour.

The Contractor shall provide watertight curbs or toe boards on barges, platforms, docks, or other surfaces over water to contain material, debris, and tools. Material shall be secured to prevent spills or discharge into water due to wind.

Structure Removal Over or Adjacent to Water

The Contractor shall not allow demolished material to enter storm water systems or watercourses. The Contractor shall use covers and platforms approved by the Engineer to collect debris. Attachments shall be used on equipment to catch debris on small demolition operations. Debris catching devices shall be emptied regularly and debris shall be handled as provided in "Waste Management" of these special provisions.

The WPCM shall inspect demolition sites within 50 feet of storm water systems or watercourses every day.

Paving, Sealing, Sawcutting, and Grinding Operations

The Contractor shall prevent the following material from entering storm drain systems or water courses:

A. Cementitious material,
B. Asphaltic material,
C. Aggregate or screenings,
D. Grinding or sawcutting residue,
E. Pavement chunks, or
F. Shoulder backing.

The Contractor shall cover drainage inlets and use linear sediment barriers to protect downhill watercourses until paving, sealing, sawcutting, or grinding operations are completed and excess material has been removed. Drainage inlets and manholes shall be covered during the application of seal coat, tack coat, slurry seal, or fog seal.

During the rainy season or when precipitation is predicted, paving, sawcutting, and grinding operations shall be limited to places where runoff can be captured. Seal coat, tack coat, slurry seal, or fog seal operations shall not begin if precipitation is predicted for the application or the curing period. The Contractor shall not excavate material from existing roadways during precipitation.

The Contractor shall vacuum up slurry from sawcutting operations immediately after the slurry is produced. Slurry shall not be allowed to run onto lanes open to public traffic or off the pavement.

The Contractor shall collect residue from portland cement concrete grinding operations with a vacuum attachment on the grinding machine. The residue shall not be left on the pavement or allowed to flow across the pavement.

Material excavated from existing roadways may be stockpiled as provided in "Stockpile Management" of these special provisions if approved by the Engineer. Asphalt concrete chunks used in embankment shall be placed above the water table and covered by at least one foot of material.

Substances used to coat asphalt trucks and equipment shall not contain soap, foaming agents, or toxic chemicals.

Thermoplastic Striping and Pavement Markers

Thermoplastic striping and preheating equipment shutoff valves shall work properly at all times when on the construction site. The Contractor shall not preheat, transfer, or load thermoplastic within 50 feet of drainage inlets or watercourses. The Contractor shall not fill the preheating container to more than 6 inches from the top. Truck beds shall be cleaned daily of scraps or melted thermoplastic.

The Contractor shall not unload, transfer, or load bituminous material for pavement markers within 50 feet of drainage inlets or watercourses. All pressure shall be released from melting tanks before removing the lid to fill or service. Melting tanks shall not be filled to more than 6 inches from the top.

The Contractor shall collect bituminous material from the roadway after marker removal.

Pile Driving

The Contractor shall keep spill kits and cleanup material at pile driving locations. Pile driving equipment shall be parked over drip pans, absorbent pads, or plastic sheeting where possible. When not in use, pile driving equipment shall be stored at least 50 feet from concentrated flows of storm water, drainage courses, or inlets. The Contractor shall protect pile driving equipment by parking it on plywood and covering it with plastic when precipitation is predicted. The WPCM shall inspect the pile driving area every day for leaks and spills.

The Contractor shall use vegetable oil instead of hydraulic fluid when practical.

Concrete Curing

The Contractor shall not overspray chemical curing compound. Drift shall be minimized by spraying as close to the concrete as possible. Drainage inlets shall be covered before applying curing compound.

The Contractor shall minimize the use and discharge of water by using wet blankets or similar methods to maintain moisture when curing concrete.

Concrete Finishing

The Contractor shall collect and dispose of water and solid waste from high-pressure water blasting. Drainage inlets within 50 feet shall be covered before sandblasting. The nozzle shall be kept as close to the surface of the concrete as possible to minimize drift of dust and blast material. Blast residue may contain hazardous material.

Containment structures for concrete finishing operations shall be inspected for damage before each day of use and before predicted precipitation. Liquid and solid waste shall be removed from the containment structure after each work shift.

DEWATERING

Dewatering shall consist of discharging accumulated storm water, ground water, or surface water from excavations or temporary containment facilities. The Contractor shall discharge water within the limits of the project.

Dewatering discharge shall not cause erosion, scour, or sedimentary deposits that impact natural bedding materials.

The Contractor shall conduct dewatering activities in accordance with the Field Guide for Construction Dewatering available at:

http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm

Before dewatering the Contractor shall submit a Dewatering and Discharge Plan to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and "Water Pollution Control," of these special provisions. At a minimum, the Dewatering and Discharge Plan shall include the following:

A. A title sheet and table of contents;
B. A description of the dewatering and discharge operations detailing the locations, quantity of water, equipment, and discharge point;
C. The estimated schedule for dewatering and discharge (begin and end dates, intermittent or continuous);
D. Discharge alternatives such as dust control or percolation; and
E. Visual monitoring procedures with inspection log.

The Contractor shall not discharge storm water or non-storm water that has an odor, discoloration other than sediment, an oily sheen, or foam on the surface and shall notify the Engineer immediately upon discovery.

If water cannot be discharged within the project limits due to site constraints it shall be disposed of in the same manner specified for material in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

PAYMENT

The contract lump sum price paid for construction site management shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in spill prevention and control, material management, waste management, non-storm water management, and dewatering and identifying, sampling, testing, handling, and disposing of hazardous waste, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.04 STREET SWEEPING

Street sweeping shall be conducted where sediment is tracked from the job site onto paved roads, as described in the approved Storm Water Pollution Prevention Plan (SWPPP) in accordance with "Water Pollution Control" of these special provisions, and as directed by the Engineer.

Street sweeping shall be one of the water pollution control practices for sediment control. The SWPPP shall include the use of street sweeping. Street sweeping shall be performed in accordance with Section 4, SC-7 in the Construction Site Best Management Practices Manual of the Caltrans Storm Water Quality Handbooks.

The number of street sweepers shall be as designated in the approved SWPPP. The Contractor shall maintain at least one sweeper on the job site at all times during the period that sweeping work is required. Sweepers shall be self-loading, motorized, and shall have spray nozzles. Sweepers may include a vacuum apparatus.

Street sweeping shall start at the beginning of clearing and grubbing and shall continue until completion of the project, or as directed by the Engineer. Street sweeping shall be performed immediately after soil disturbing activities occur or offsite tracking of material is observed. Street sweeping shall be performed so that dust is minimized. If dust generation is excessive or sediment pickup is ineffective as determined by the Engineer, the use of water or a vacuum will be required.

At the option of the Contractor, collected material may be temporarily stockpiled in accordance with the approved SWPPP. Collected material shall be disposed of at least once per week.

Material collected during street sweeping operations shall be disposed of in conformance with Section 7-1.13, "Disposal of Material Outside The Highway Right Of Way," of the Standard Specifications.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for street sweeping shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in street sweeping, including disposal of collected material, as shown on the plans, as specified in the Standard Specifications, these special provisions, and as directed by the Engineer.

10-1.05 TEMPORARY CONCRETE WASHOUT FACILITY

Temporary concrete washout facilities shall be constructed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Temporary concrete washout facilities shall be one of the water pollution control practices for waste management and materials pollution control. The SWPPP shall include the use of temporary concrete washout facilities.

MATERIALS

Plastic Liner

Plastic liners shall be single ply, new polyethylene sheeting, a minimum of 10 mils thick and shall be free of holes, punctures, tears or other defects that compromise the impermeability of the material. Plastic liners shall not have seams or overlapping joints.

Gravel-filled Bags

Gravel bag fabric shall be nonwoven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, min. ASTM Designation: D 5261	8.0
Grab tensile strength (one inch grip), kilonewtons, min. ASTM Designation: D 4632*	205
Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D 4355, xenon arc lamp method	70

* or appropriate test method for specific polymer

Gravel bags shall be between 24 inches and 32 inches in length, and between 16 inches and 20 inches in width.

Yarn used for binding gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color.

Gravel shall be between 3/8 inch and 3/4 inch in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials.

The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 30 pounds and 50 pounds in weight.

Straw Bales

Straw for straw bales shall conform to the provisions in Section 20-2.06, "Straw," of the Standard Specifications.

Straw bales shall be a minimum of 14 inches in width, 18 inches in height, 36 inches in length and shall have a minimum weight of 50 pounds. The straw bale shall be composed entirely of vegetative matter, except for binding material.

Straw bales shall be bound by either wire, nylon or polypropylene string. Jute or cotton binding shall not be used. Baling wire shall be a minimum of 16 gage in diameter. Nylon or polypropylene string shall be approximately 0.08-inch in diameter with 80 pounds of breaking strength.

Stakes

Stakes shall be wood or metal. Wood stakes shall be untreated fir, redwood, cedar, or pine and cut from sound timber. They shall be straight and free of loose or unsound knots or other defects which would render them unfit for the purpose intended. Wood stakes shall be a minimum 2" x 2" in size. Metal stakes may be used as an alternative, and shall be a minimum of 0.5-inch in diameter. Stakes shall be a minimum of 4 feet in length. The tops of the metal stakes shall be bent at a 90-degree angle or capped with an orange or red plastic safety cap that fits snugly to the metal stake. The Contractor shall submit a sample of the metal stake and plastic cap, if used, for the Engineer's approval before installation.

Staples

Staples shall be as shown on the plans. An alternative attachment device such as geotextile pins or plastic pegs may be used instead of staples. The Contractor shall submit a sample of the alternative attachment device for the Engineer's approval before installation.

Signs

Wood posts for signs shall conform to the provisions in Section 56-2.02B, "Wood Posts," of the Standard Specifications. Lag screws shall conform to the provisions in Section 56-2.02D, "Sign Panel Fastening Hardware," of the Standard Specifications.

Plywood shall be freshly painted for each installation with not less than 2 applications of flat white paint. Sign letters shown on the plans shall be stenciled with commercial quality exterior black paint. Testing of paint will not be required.

INSTALLATION

Temporary concrete washout facilities shall be as follows:

1. Temporary concrete washout facilities shall be installed before beginning placement of concrete and located a minimum of 50 feet from storm drain inlets, open drainage facilities, and water courses unless determined infeasible by the Engineer. Temporary concrete washout facilities shall be located away from construction traffic or access areas at a location determined by the Contractor and approved by the Engineer.

2. A sign shall be installed adjacent to each washout facility at a location determined by the Contractor and approved by the Engineer. Signs shall be installed in conformance with the provisions in Section 56-2.03, "Construction," and Section 56-2.04, "Sign Panel Installation," of the Standard Specifications.
3. The length and width of a temporary concrete washout facility may be increased from the minimum dimensions shown on the plans upon approval of the Engineer.
4. Temporary concrete washout facilities shall be constructed in sufficient quantity and size to contain liquid and concrete waste generated by washout operations for concrete wastes. These facilities shall be constructed to contain liquid and concrete waste without seepage, spills, or overflow.
5. Berms for below grade temporary concrete washout facilities shall be constructed from compacted native material. Gravel may be used in conjunction with compacted native material.
6. A plastic liner shall be installed in below grade temporary concrete washout facilities.

Details for an alternative temporary concrete washout facility shall be submitted to the Engineer for approval at least 7 days before installation.

When temporary concrete washout facilities are no longer required for the work, as determined by the Engineer, the hardened concrete and liquid residue shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Temporary concrete washout facilities shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary concrete washout facilities shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MAINTENANCE

Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 12 inches. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the Standard Specifications. Holes, rips, and voids in the plastic liner shall be patched and repaired by taping or the plastic liner shall be replaced. The plastic liner shall be replaced when patches or repairs compromise the impermeability of the material as determined by the Engineer.

Gravel bags shall be replaced when the bag material is ruptured or when the yarn has failed, allowing the bag contents to spill out.

Temporary concrete washout facilities shall be repaired or replaced on the same day the damage occurs. Damage to temporary concrete washout facilities resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor’s expense.

MEASUREMENT AND PAYMENT

Quantities of temporary concrete washout facilities will be measured as units determined from actual count in place.

The contract unit price paid for temporary concrete washout facility shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing a temporary concrete washout facility, complete in place, including excavation and backfill, maintenance, and removal, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.06 TEMPORARY FIBER ROLL

Temporary fiber roll shall be furnished, installed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Temporary fiber roll shall be installed on disturbed soil areas, active or nonactive.

Temporary fiber roll shall be one of the water pollution control practices for sediment control. The SWPPP shall include the use of temporary fiber roll.

Temporary fiber roll shall be either Type 1 or Type 2.

MATERIALS

Fiber Roll

Fiber roll shall be either:

1. Constructed with a premanufactured blanket consisting of either wood excelsior, rice or wheat straw, or coconut fibers or a combination of these materials. The blanket shall be between 6 feet and 8 feet in width and between 65 feet and 95 feet in length. Wood excelsior shall be individual fibers, of which 80 percent shall be 6 inches or longer in length. The blanket shall have a photodegradable plastic netting or biodegradable jute, sisal, or coir fiber netting on at least one side. The blanket shall be rolled along the width and secured with jute twine spaced 6 feet apart along the full length of the roll and placed 6 inches from the ends of each roll. The finished roll shall be between 8 inches and 10 inches in diameter, a minimum of 20 feet in length, and shall weigh a minimum of 0.5 pound per linear foot. More than one blanket may be required to achieve the finished roll diameter. When more than one blanket is required, blankets shall be jointed longitudinally with an overlap of 6 inches along the length of the blanket.
2. A premanufactured roll of rice or wheat straw, wood excelsior, or coconut fiber encapsulated within a photodegradable plastic or biodegradable jute, sisal, or coir fiber netting. The netting shall have a minimum durability of one year after installation. The netting shall be secured tightly at each end of the roll. Rolls shall be between 8 inches and 12 inches in diameter. Rolls between 8 inches and 10 inches in diameter shall have a minimum weight of 1 pound per linear foot and a minimum length of 20 feet. Rolls between 10 inches and 12 inches in diameter shall have a minimum weight of 3 pounds per linear foot and a minimum length of 10 feet.

Stakes

Wood stakes shall be a minimum of 1" x 1" x 24" in size for Type 1 installation, or a minimum of 1" x 2" x 24" in size for Type 2 installation. Wood stakes shall be untreated fir, redwood, cedar, or pine and cut from sound timber. They shall be straight and free of loose or unsound knots and other defects which would render them unfit for the purpose intended. Metal stakes shall not be used.

Rope

Rope shall be biodegradable, such as sisal or manila, with a minimum diameter of 1/4 inch.

INSTALLATION

Temporary fiber roll shall be installed as follows:

1. Temporary fiber roll (Type 1): Furrows shall be constructed to a depth between 2 inches and 4 inches, and to a sufficient width to hold the fiber roll. Stakes shall be installed 24 inches apart along the length of the fiber rolls and stopped at 12 inches from each end of the rolls. Stakes shall be driven to a maximum of 2 inches above, or flush with the top of the roll.
2. Temporary fiber roll (Type 2): Rope and notched stakes shall be used to restrain the fiber rolls against the slope. Stakes shall be driven into the slope until the notch is even with the top of the fiber roll. Rope shall be knotted at each stake and laced between stakes. After installation of the rope, stakes shall be driven into the slope such that the rope will hold the fiber roll tightly to the slope. Furrows will not be required.
3. The bedding area for the fiber roll shall be cleared of obstructions including rocks, clods, and debris greater than one inch in diameter before installation.
4. Temporary fiber rolls shall be installed approximately parallel to the slope contour.

When no longer required, as determined by the Engineer, temporary fiber rolls shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Temporary fiber rolls may be abandoned in place when approved in writing by the Engineer.

Ground disturbances including holes and depressions caused by the installation and removal of the temporary fiber roll shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MAINTENANCE

Temporary fiber rolls shall be maintained to disperse concentrated water runoff and to reduce runoff velocities. Split, torn, or unraveling rolls shall be repaired or replaced. Broken or split stakes shall be replaced. Sagging or slumping fiber rolls shall be repaired with additional stakes or replaced. Locations where rills and other evidence of concentrated runoff have occurred beneath the rolls shall be corrected. Temporary fiber rolls shall be repaired or replaced within 24 hours of identifying the deficiency.

MEASUREMENT AND PAYMENT

Quantities of temporary fiber rolls to be paid for will be determined by the linear foot measured along the centerline of the installed roll. Where temporary fiber rolls are joined and overlapped, the overlap will be measured as a single installed roll.

The contract price paid per linear foot for temporary fiber roll shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary fiber rolls, complete in place, including furrow excavation and backfill, and removal, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Damage to temporary fiber rolls resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

The cost of maintaining temporary fiber rolls will be borne equally by the State and the Contractor. The division of cost will be made by determining the cost of maintaining temporary fiber rolls in conformance with the provisions in Section 9-1.03, "Force Account Payment," of the Standard Specifications and paying half of that cost to the Contractor.

Cleanup, repair, removal, disposal, or replacement due to improper installation or the Contractor's negligence will not be considered as included in the cost for performing maintenance.

10-1.07 TEMPORARY GRAVEL BAG BERM

Temporary gravel bag berms shall be furnished, installed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Temporary gravel bag berms shall be one of the water pollution control practices for sediment control. The Storm Water Pollution Prevention Plan shall include the use of temporary gravel bag berms.

MATERIALS

Gravel-filled Bags

Gravel bag fabric shall be nonwoven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, min. ASTM Designation: D 5261	8.0
Grab tensile strength (one inch grip), pounds, min. ASTM Designation: D 4632*	200
Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D 4355, xenon arc lamp method	70

* or appropriate test method for specific polymer

Gravel bags shall be between 24 inches and 32 inches in length, and between 16 inches and 20 inches in width.

Yarn used for binding gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color.

Gravel shall be between 3/8 inch and 3/4 inch in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials. The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 30 pounds and 50 pounds in weight.

INSTALLATION

Temporary gravel bag berms shall be installed as follows:

A. A single layer of gravel bags shall be placed with ends abutted tightly and not overlapped.
B. The bedding area for the temporary gravel bag berm shall be cleared of obstructions, including rocks, clods, and debris greater than one inch in diameter, prior to installation.
C. Temporary gravel bag berms shall be installed approximately parallel to the slope contour.
D. The last 6 feet of the temporary gravel bag berm shall be angled up-slope.

When no longer required, as determined by the Engineer, temporary gravel bag berm shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary gravel bag berm shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MAINTENANCE

Temporary gravel bag berms shall be maintained to provide a sediment holding capacity of approximately 1/3 the height of the gravel bag berm above the ground. When sediment exceeds this height, or when directed by the Engineer, sediment shall be removed. Removed sediment shall be deposited within the project limits in such a way that the sediment is not subject to erosion by wind or by water.

Temporary gravel bag berms shall be repaired or replaced on the same day the damage occurs. Damage to the temporary gravel bag berm resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

Gravel bags shall be replaced when the bag material is ruptured or when the yarn has failed, allowing the bag contents to spill out.

MEASUREMENT AND PAYMENT

Quantities of temporary gravel bag berm to be paid for will be determined by the linear foot, measured along the centerline of the installed temporary gravel bag berm.

The contract price paid per linear foot for temporary gravel bag berm shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary gravel bag berm, complete in place, including backfill, maintenance, and removal, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.08 TEMPORARY CONSTRUCTION ENTRANCE

Temporary construction entrances shall be constructed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.

Temporary construction entrances shall be one of the water pollution control practices for tracking control. The SWPPP shall include the use of temporary construction entrances.

Temporary construction entrances shall be Type 2.

MATERIALS

Temporary Entrance Fabric

Temporary entrance fabric shall be manufactured from polyester, nylon, or polypropylene material, or any combination thereof. Temporary entrance fabric shall be a nonwoven, needle-punched fabric, free of needles which may have broken off during the manufacturing process. Temporary entrance fabric shall be permeable and shall not act as a wicking agent.

Temporary entrance fabric shall be manufactured from virgin, recycled, or a combination of virgin and recycled polymer materials. No virgin or recycled materials shall contain biodegradable filler materials that can degrade the physical or chemical characteristics of the finished fabric. The Engineer may order tests to confirm the absence of biodegradable filler materials in conformance to the requirements in ASTM Designation: E 204 (Fourier Transformed Infrared Spectroscopy-FTIR).

Temporary entrance fabric shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, min. ASTM Designation: D 5261	6.5
Grab tensile strength (one inch grip), pounds, min. ASTM Designation: D 4632*	200
Elongation at break, percent min. ASTM Designation: D 4632*	50
Toughness, pounds, min. (percent elongation x grab tensile strength)	12,000

* or appropriate test method for specific polymer

Rocks

Rocks shall conform to the material quality requirements in Section 72-2.02, "Materials," of the Standard Specifications for shape and for apparent specific gravity, absorption, and durability index. Rocks used for the temporary entrance shall conform to the following sizes:

Square Screen Size (inch)	Percentage Passing	Percentage Retained
6	100	0
3	0	100

Corrugated Steel Panels

Corrugated steel panels shall be prefabricated and shall be pressed or shop welded, with a slot or hooked section to facilitate coupling at the ends of the panels.

INSTALLATION

Temporary construction entrances shall be installed as follows:

1. Before placing the temporary entrance fabric, the areas shall be cleared of all trash and debris. Vegetation shall be removed to the ground level. Trash, debris, and removed vegetation shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.
2. A sump shall be constructed within 20 feet of each temporary construction entrance as shown on the plans.
3. Before placing the temporary entrance fabric, the ground shall be graded to a uniform plane. The relative compaction of the top 1.5 feet shall be not less than 90 percent. The ground surface shall be free of sharp objects that may damage the temporary entrance fabric, and shall be graded to drain to the sump as shown on the plans.
4. Temporary entrance fabric shall be positioned longitudinally along the alignment of the entrance, as directed by the Engineer.
5. The adjacent ends of the fabric shall be overlapped a minimum length of 12 inches.
6. Rocks to be placed directly over the fabric shall be spread in the direction of traffic, longitudinally and along the alignment of the temporary construction entrance.
7. During spreading of the rocks, vehicles or equipment shall not be driven directly on the fabric. A layer of rocks a minimum 6 inches thick shall be placed between the fabric and the spreading equipment to prevent damage to the fabric.
8. For Type 2 temporary construction entrances, a minimum of 6 coupled panel sections shall be installed for each temporary construction entrance. Before installing the panels, the ground surface shall be cleared of all debris to ensure uniform contact with the ground surface.

Fabric damaged during rock placement shall be repaired by placing a new piece of fabric over the damaged area. The piece of fabric shall be large enough to cover the damaged area and provide a minimum 18-inch overlap on all edges.

Details for a proposed alternative temporary construction entrance or alternative sump shall be submitted to the Engineer for approval at least 7 days before installation. The Contractor may eliminate the sump if approved in writing by the Engineer.

When no longer required as determined by the Engineer, temporary construction entrances shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary construction entrance, including the sumps, shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

While the temporary construction entrance is in use, pavement shall be cleaned and sediment removed at least once a day, and as often as necessary when directed by the Engineer. Soil and sediment or other extraneous material tracked onto existing pavement shall not be allowed to enter drainage facilities.

MAINTENANCE

The Contractor shall maintain temporary construction entrances throughout the contract or until removed. The Contractor shall prevent displacement or migration of the rock surfacing or corrugated steel panels. Significant depressions resulting from settlement or heavy equipment shall be repaired by the Contractor as directed by the Engineer.

Temporary construction entrances shall be maintained to minimize tracking of soil and sediment onto existing public roads.

If buildup of soil and sediment deter the function of the temporary construction entrance, the Contractor shall immediately remove and dispose of the soil and sediment, and install additional corrugated steel panels and spread additional rocks to increase the capacity of the temporary construction entrance.

Temporary construction entrances shall be repaired or replaced on the same day the damage occurs. Damage to the temporary construction entrance resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

MEASUREMENT AND PAYMENT

Quantities of temporary construction entrances will be determined from actual count in place.

The contract unit price paid for temporary construction entrance shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing temporary construction entrance, complete in place, including excavation and backfill, maintenance, and removal, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.09 TEMPORARY DRAINAGE INLET PROTECTION

Temporary drainage inlet protection shall be constructed, maintained, and removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in accordance with "Water Pollution Control" of these special provisions, and in accordance with the details shown on the plans and these special provisions.

Temporary drainage inlet protection shall be one of the water pollution control practices for sediment control. The SWPPP shall include the use of temporary drainage inlet protection.

The Contractor shall select the appropriate drainage inlet protection in accordance with the details to meet the conditions around the drainage inlet. Throughout the duration of the contract, the Contractor shall provide protection to meet the changing conditions around the drainage inlet.

Temporary drainage inlet protection shall be Type 3A.

MATERIALS

Gravel-filled Bags

Gravel-filled bag fabric shall be nonwoven polypropylene geotextile or polymer material and shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, minimum ASTM Designation: D 5261	8.0
Grab tensile strength (one inch grip), pounds, minimum ASTM Designation: D 4632*	200
Ultraviolet stability, percent tensile strength retained after 500 hours minimum ASTM Designation: D 4355, xenon arc lamp method	70

* or appropriate test method for specific polymer

Gravel-filled bags shall be between 24 inches and 32 inches in length, and between 16 inches and 20 inches in width.

Yarn used for binding gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color.

Gravel shall be between 3/8 inch and 3/4 inch in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials. The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 30 pounds and 50 pounds in weight.

INSTALLATION

Temporary drainage inlet protection shall be installed at drainage inlets in paved and unpaved areas as follows:

A. Temporary drainage inlet protection shall be installed such that ponded runoff does not encroach on the traveled way or overtop the curb or dike. Gravel-filled bags shall be placed to control ponding and prevent runoff from overtopping the curb or dike.
B. The bedding area for the temporary drainage inlet protection shall be cleared of obstructions including rocks, clods, and debris greater than one inch in diameter before installation.

C. A temporary linear sediment barrier shall be installed up-slope of the existing drainage inlet and parallel with the curb, dike, or flow line to prevent sediment from entering the drainage inlet.

Gravel-filled Bags

Gravel-filled bags shall be stacked to form a gravel bag barrier. The gravel-filled bags shall be placed so that the bags are tightly abutted and overlap the joints in adjacent rows. A spillway shall be created by removing one or more gravel-filled bags from the upper layer of the gravel bag barrier.

Gravel-filled bags shall only be used within shoulder areas when placed behind temporary railing (Type K).

MAINTENANCE

Temporary drainage inlet protection shall be maintained to provide sediment holding capacity and to reduce runoff velocities. Temporary drainage inlet protection shall be repaired or replaced immediately after the damage occurs.

Sediment deposits, trash, and debris shall be removed from temporary drainage inlet protection as needed or when directed by the Engineer. Removed sediment shall be deposited within the project limits so that the sediment is not subject to erosion by wind or by water. Trash and debris shall be removed and disposed of in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

At locations where rills and other evidence of concentrated runoff have occurred beneath the drainage inlet protection, the protection shall be adjusted to prevent another occurrence.

Sediment deposits shall be removed when the deposit is 1/3 the height of the gravel bag barrier or one half the height of the spillway; whichever is less.

Gravel-filled bags shall be replaced when the bag material ruptures or when the binding fails.

REMOVAL

When the temporary drainage inlet protection is no longer required the protection materials shall be removed and disposed of in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Holes, depressions, or other ground disturbance caused by the removal of the temporary drainage inlet protection shall be backfilled and repaired in accordance with the provisions in Section 15-1.02, "Preservation of Property," of the Standard Specifications.

MEASUREMENT

Quantities of temporary drainage inlet protection will be determined from actual count in place. The protection will be measured one time only and no additional measurement will be recognized.

PAYMENT

The contract unit price paid for temporary drainage inlet protection shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the temporary drainage inlet protection, complete in place, including maintenance, removal of materials, including cleanup and disposal of retained sediment and debris, and backfilling and repairing holes, depressions and other ground disturbance, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

No additional compensation will be made if the temporary drainage inlet protection changes during the course of construction.

10-1.10 COOPERATION

It is anticipated that work by another contractor may be in progress adjacent to or within the limits of this project during progress of the work on this contract. The following table lists contracts anticipated to be in progress during this contract.

Contract No.	Co-Rte-KP	Location	Type of Work
08-3770U4		In the city of Fontana at Victoria Street at the southeast quadrant of Route 15 and Route 210 interchange	Construct a Park-n-Ride facility and all infrastructure improvements for the future Transportation Management Center and Southern Regional Laboratory

Comply with Section 7-1.14, "Cooperation," of the Standard Specifications.

10-1.11 PROGRESS SCHEDULE (CRITICAL PATH METHOD)

The Contractor shall submit to the Engineer practicable critical path method (CPM) progress schedules in conformance with these special provisions. Whenever the term "schedule" is used in this section it shall mean CPM progress schedule.

Attention is directed to "Payments" of Section 5 of these special provisions.

The provisions in Section 8-1.04, "Progress Schedule," of the Standard Specifications shall not apply.

DEFINITIONS

The following definitions shall apply to this section:

A. ACTIVITY.—A task, event or other project element on a schedule that contributes to completing the project. Activities have a description, start date, finish date, duration and one or more logic ties.
B. BASELINE SCHEDULE.—The initial schedule representing the Contractor's work plan on the first working day of the project.
C. CONTRACT COMPLETION DATE.—The current extended date for completion of the contract shown on the weekly statement of working days furnished by the Engineer in conformance with the provisions in Section 8-1.06, "Time of Completion," of the Standard Specifications.
D. CRITICAL PATH.—The longest continuous chain of activities for the project that has the least amount of total float of all chains. In general, a delay on the critical path will extend the scheduled completion date.
E. CRITICAL PATH METHOD (CPM).—A network based planning technique using activity durations and the relationships between activities to mathematically calculate a schedule for the entire project.
F. DATA DATE.—The day after the date through which a schedule is current. Everything occurring earlier than the data date is "as-built" and everything on or after the data date is "planned."
G. EARLY COMPLETION TIME.—The difference in time between an early scheduled completion date and the contract completion date.
H. FLOAT.—The difference between the earliest and latest allowable start or finish times for an activity.
I. MILESTONE.—An event activity that has zero duration and is typically used to represent the beginning or end of a certain stage of the project.
J. NARRATIVE REPORT.—A document submitted with each schedule that discusses topics related to project progress and scheduling.
K. NEAR CRITICAL PATH.—A chain of activities with total float exceeding that of the critical path but having no more than 10 working days of total float.
L. SCHEDULED COMPLETION DATE.—The planned project finish date shown on the current accepted schedule.
M. STATE OWNED FLOAT ACTIVITY.—The activity documenting time saved on the critical path by actions of the State. It is the last activity prior to the scheduled completion date.
N. TIME IMPACT ANALYSIS.—A schedule and narrative report developed specifically to demonstrate what effect a proposed change or delay has on the current scheduled completion date.
O. TOTAL FLOAT.—The amount of time that an activity or chain of activities can be delayed before extending the scheduled completion date.
P. UPDATE SCHEDULE.—A current schedule developed from the baseline or subsequent schedule through regular monthly review to incorporate as-built progress and any planned changes.

GENERAL REQUIREMENTS

The Contractor shall submit to the Engineer baseline, monthly update and final update schedules, each consistent in all respects with the time and order of work requirements of the contract. The project work shall be executed in the sequence indicated on the current accepted schedule.

Schedules shall show the order in which the Contractor proposes to carry out the work with logical links between time-scaled work activities, and calculations made using the critical path method to determine the controlling operation or operations. The Contractor is responsible for assuring that all activity sequences are logical and that each schedule shows a coordinated plan for complete performance of the work.

The Contractor shall produce schedules using computer software and shall furnish compatible software for the Engineer's exclusive possession and use. The Contractor shall furnish network diagrams, narrative reports, tabular reports and schedule data as parts of each schedule submittal.

Schedules shall include, but not be limited to, activities that show the following that are applicable to the project:

A. Project characteristics, salient features, or interfaces, including those with outside entities, that could affect time of completion.
B. Project start date, scheduled completion date and other milestones.
C. Work performed by the Contractor, subcontractors and suppliers.

D. Submittal development, delivery, review and approval, including those from the Contractor, subcontractors and suppliers.
E. Procurement, delivery, installation and testing of materials, plants and equipment.
F. Testing and settlement periods.
G. Utility notification and relocation.
H. Erection and removal of falsework and shoring.
I. Major traffic stage switches.
J. Finishing roadway and final cleanup.
K. State-owned float as the predecessor activity to the scheduled completion date.

Schedules shall have not less than 50 and not more than 500 activities, unless otherwise authorized by the Engineer. The number of activities shall be sufficient to assure adequate planning of the project, to permit monitoring and evaluation of progress, and to do an analysis of time impacts.

Schedule activities shall include the following:

A. A clear and legible description.
B. Start and finish dates.
C. A duration of not less than one working day, except for event activities, and not more than 20 working days, unless otherwise authorized by the Engineer.
D. At least one predecessor and one successor activity, except for project start and finish milestones.
E. Required constraints.
F. Codes for responsibility, stage, work shifts, location and contract pay item numbers.

The Contractor may show early completion time on any schedule provided that the requirements of the contract are met. Early completion time shall be considered a resource for the exclusive use of the Contractor. The Contractor may increase early completion time by improving production, reallocating resources to be more efficient, performing sequential activities concurrently or by completing activities earlier than planned. The Contractor may also submit for approval a cost reduction incentive proposal in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications that will reduce time of construction.

The Contractor may show a scheduled completion date that is later than the contract completion date on an update schedule, after the baseline schedule is accepted. The Contractor shall provide an explanation for a late scheduled completion date in the narrative report that is included with the schedule.

State-owned float shall be considered a resource for the exclusive use of the State. The Engineer may accrue State-owned float by the early completion of review of any type of required submittal when it saves time on the critical path. The Contractor shall prepare a time impact analysis, when requested by the Engineer, to determine the effect of the action in conformance with the provisions in "Time Impact Analysis" specified herein. The Engineer will document State-owned float by directing the Contractor to update the State-owned float activity on the next update schedule. The Contractor shall include a log of the action on the State-owned float activity and include a discussion of the action in the narrative report. The Engineer may use State-owned float to mitigate past, present or future State delays by offsetting potential time extensions for contract change orders.

The Engineer may adjust contract working days for ordered changes that affect the scheduled completion date, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications. The Contractor shall prepare a time impact analysis to determine the effect of the change in conformance with the provisions in "Time Impact Analysis" specified herein, and shall include the impacts acceptable to the Engineer in the next update schedule. Changes that do not affect the controlling operation on the critical path will not be considered as the basis for a time adjustment. Changes that do affect the controlling operation on the critical path will be considered by the Engineer in decreasing time or granting an extension of time for completion of the contract. Time extensions will only be granted if the total float is absorbed and the scheduled completion date is delayed one or more working days because of the ordered change.

The Engineer's review and acceptance of schedules shall not waive any contract requirements and shall not relieve the Contractor of any obligation thereunder or responsibility for submitting complete and accurate information. Schedules that are rejected shall be corrected by the Contractor and resubmitted to the Engineer within 5 working days of notification by the Engineer, at which time a new review period of one week will begin.

Errors or omissions on schedules shall not relieve the Contractor from finishing all work within the time limit specified for completion of the contract. If, after a schedule has been accepted by the Engineer, either the Contractor or the Engineer discover that any aspect of the schedule has an error or omission, it shall be corrected by the Contractor on the next update schedule.

COMPUTER SOFTWARE

The Contractor shall submit to the Engineer for approval a description of proposed software before delivery. The software shall be the current version of Primavera SureTrak Project Manager for Windows, or equal, and shall be compatible with Windows NT (version 4.0) operating system. If software other than SureTrak is proposed, it shall be capable of generating files that can be imported into SureTrak.

The Contractor shall furnish schedule software and all original software instruction manuals to the Engineer with submittal of the baseline schedule. The furnished schedule software shall become the property of the State and will not be returned to the Contractor. The State will compensate the Contractor in conformance with the provisions in Section 4-1.03, "Extra Work," of the Standard Specifications for replacement of software which is damaged, lost or stolen after delivery to the Engineer.

The Contractor shall instruct the Engineer in the use of the software and provide software support until the contract is accepted. Within 20 working days of contract approval, the Contractor shall provide a commercial 8-hour training session for 2 Department employees in the use of the software at a location acceptable to the Engineer. It is recommended that the Contractor also send at least 2 employees to the same training session to facilitate development of similar knowledge and skills in the use of the software. If software other than SureTrak is furnished, then the training session shall be a total of 16-hours for each Department employee.

NETWORK DIAGRAMS, REPORTS AND DATA

The Contractor shall include the following for each schedule submittal:

A. Two sets of originally plotted, time-scaled network diagrams.
B. Two copies of a narrative report.
C. Two copies of each of 3 sorts of the CPM software-generated tabular reports.
D. One 1.44-megabyte 3.5 inch floppy diskette containing the schedule data.

The time-scaled network diagrams shall conform to the following:

A. Show a continuous flow of information from left to right.
B. Be based on early start and early finish dates of activities.
C. Clearly show the primary paths of criticality using graphical presentation.
D. Be prepared on E-size sheets, 34" x 44".
E. Include a title block and a timeline on each page.

The narrative report shall be organized in the following sequence with all applicable documents included:

A. Contractor's transmittal letter.
B. Work completed during the period.
C. Identification of unusual conditions or restrictions regarding labor, equipment or material; including multiple shifts, 6-day work weeks, specified overtime or work at times other than regular days or hours.
D. Description of the current critical path.
E. Changes to the critical path and scheduled completion date since the last schedule submittal.
F. Description of problem areas.
G. Current and anticipated delays:

    1. Cause of delay.
    2. Impact of delay on other activities, milestones and completion dates.
    3. Corrective action and schedule adjustments to correct the delay.

H. Pending items and status thereof:

    1. Permits.
    2. Change orders.
    3. Time adjustments.
    4. Noncompliance notices.

I. Reasons for an early or late scheduled completion date in comparison to the contract completion date.

Tabular reports shall be software-generated and provide information for each activity included in the project schedule. Three different reports shall be sorted by (1) activity number, (2) early start and (3) total float. Tabular reports shall be 8-1/2" x 11" in size and shall include, as a minimum, the following applicable information:

A. Data date.
B. Activity number and description.
C. Predecessor and successor activity numbers and descriptions.
D. Activity codes.
E. Scheduled, or actual and remaining durations (work days) for each activity.
F. Earliest start (calendar) date.
G. Earliest finish (calendar) date.
H. Actual start (calendar) date.
I. Actual finish (calendar) date.
J. Latest start (calendar) date.
K. Latest finish (calendar) date.
L. Free float (work days).
M. Total float (work days).
N. Percentage of activity complete and remaining duration for incomplete activities.
O. Lags.
P. Required constraints.

Schedule submittals will only be considered complete when all documents and data have been provided as described above.

PRE-CONSTRUCTION SCHEDULING CONFERENCE

The Contractor shall schedule and the Engineer will conduct a pre-construction scheduling conference with the Contractor's project manager and construction scheduler within 10 working days of the approval of the contract. At this meeting the Engineer will review the requirements of this section of the special provisions with the Contractor.

The Contractor shall submit a general time-scaled logic diagram displaying the major activities and sequence of planned operations and shall be prepared to discuss the proposed work plan and schedule methodology that comply with the requirements of these special provisions. If the Contractor proposes deviations to the construction staging of the project, then the general time-scaled logic diagram shall also display the deviations and resulting time impacts. The Contractor shall be prepared to discuss the proposal.

At this meeting, the Contractor shall additionally submit the alphanumeric coding structure and the activity identification system for labeling the work activities. To easily identify relationships, each activity description shall indicate its associated scope or location of work by including such terms as quantity of material, type of work, bridge number, station to station location, side of highway (such as left, right, northbound, southbound), lane number, shoulder, ramp name, ramp line descriptor or mainline.

The Engineer will review the logic diagram, coding structure, and activity identification system, and provide any required baseline schedule changes to the Contractor for implementation.

BASELINE SCHEDULE

Beginning the week following the pre-construction scheduling conference, the Contractor shall meet with the Engineer weekly until the baseline schedule is accepted by the Engineer to discuss schedule development and resolve schedule issues.

The Contractor shall submit to the Engineer a baseline schedule within 20 working days of approval of the contract. The Contractor shall allow 3 weeks for the Engineer's review after the baseline schedule and all support data are submitted. In addition, the baseline schedule submittal will not be considered complete until the computer software is delivered and installed for use in review of the schedule.

The baseline schedule shall include the entire scope of work and how the Contractor plans to complete all work contemplated. The baseline schedule shall show the activities that define the critical path. Multiple critical paths and near-critical paths shall be kept to a minimum. A total of not more than 50 percent of the baseline schedule activities shall be critical or near critical, unless otherwise authorized by the Engineer.

The baseline schedule shall not extend beyond the number of working days specified in these special provisions. The baseline schedule shall have a data date of the first working day of the contract and not include any completed work to date. The baseline schedule shall not attribute negative float or negative lag to any activity.

If the Contractor submits an early completion baseline schedule that shows contract completion in less than 85 percent of the working days specified in these special provisions, the baseline schedule shall be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations shall be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for the Contractor and subcontractors. The Contractor shall use average composite crews to display the labor loading of on-site construction activities. The Contractor shall optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms shall show labor crafts and equipment classes to be utilized on the contract. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable.

UPDATE SCHEDULE

The Contractor shall submit an update schedule and meet with the Engineer to review contract progress, on or before the first day of each month, beginning one month after the baseline schedule is accepted. The Contractor shall allow 2 weeks for the Engineer's review after the update schedule and all support data are submitted, except that the review period shall not start until the previous month's required schedule is accepted. Update schedules that are not accepted or rejected within the review period will be considered accepted by the Engineer.

The update schedule shall have a data date of the twenty-first day of the month or other date established by the Engineer. The update schedule shall show the status of work actually completed to date and the work yet to be performed as planned. Actual activity start dates, percent complete and finish dates shall be shown as applicable. Durations for work that has been completed shall be shown on the update schedule as the work actually occurred, including Engineer submittal review and Contractor resubmittal times.

The Contractor may include modifications such as adding or deleting activities or changing activity constraints, durations or logic that do not (1) alter the critical path(s) or near critical path(s) or (2) extend the scheduled completion date compared to that shown on the current accepted schedule. The Contractor shall state in writing the reasons for any changes to planned work. If any proposed changes in planned work will result in (1) or (2) above, then the Contractor shall submit a time impact analysis as described herein.

TIME IMPACT ANALYSIS

The Contractor shall submit a written time impact analysis (TIA) to the Engineer with each request for adjustment of contract time, or when the Contractor or Engineer consider that an approved or anticipated change may impact the critical path or contract progress.

The TIA shall illustrate the impacts of each change or delay on the current scheduled completion date or internal milestone, as appropriate. The analysis shall use the accepted schedule that has a data date closest to and prior to the event. If the Engineer determines that the accepted schedule used does not appropriately represent the conditions prior to the event, the accepted schedule shall be updated to the day before the event being analyzed. The TIA shall include an impact schedule developed from incorporating the event into the accepted schedule by adding or deleting activities, or by changing durations or logic of existing activities. If the impact schedule shows that incorporating the event modifies the critical path and scheduled completion date of the accepted schedule, the difference between scheduled completion dates of the two schedules shall be equal to the adjustment of contract time. The Engineer may construct and utilize an appropriate project schedule or other recognized method to determine adjustments in contract time until the Contractor provides the TIA.

The Contractor shall submit a TIA in duplicate within 15 working days of receiving a written request for a TIA from the Engineer. The Contractor shall allow the Engineer 2 weeks after receipt to approve or reject the submitted TIA. All approved TIA schedule changes shall be shown on the next update schedule.

If a TIA submitted by the Contractor is rejected by the Engineer, the Contractor shall meet with the Engineer to discuss and resolve issues related to the TIA. If agreement is not reached, the Contractor will be allowed 15 days from the meeting with the Engineer to give notice in conformance with the provisions in Section 9-1.04, "Notice of Potential Claim," of the Standard Specifications. The Contractor shall only show actual as-built work, not unapproved changes related to the TIA, in subsequent update schedules. If agreement is reached at a later date, approved TIA schedule changes shall be shown on the next update schedule. The Engineer will withhold remaining payment on the schedule contract item if a TIA is requested by the Engineer and not submitted by the Contractor within 15 working days. The schedule item payment will resume on the next estimate after the requested TIA is submitted. No other contract payment will be retained regarding TIA submittals.

FINAL UPDATE SCHEDULE

The Contractor shall submit a final update, as-built schedule with actual start and finish dates for the activities, within 30 days after completion of contract work. The Contractor shall provide a written certificate with this submittal signed by the Contractor's project manager and an officer of the company stating, "To my knowledge and belief, the enclosed final update schedule reflects the actual start and finish dates of the actual activities for the project contained herein." An officer of the company may delegate in writing the authority to sign the certificate to a responsible manager.

RETENTION

The Department will retain an amount equal to 25 percent of the estimated value of the work performed during each estimate period in which the Contractor fails to submit an acceptable schedule conforming to the requirements of these special provisions as determined by the Engineer. Schedule retentions will be released for payment on the next monthly estimate for partial payment following the date that acceptable schedules are submitted to the Engineer or as otherwise specified herein. Upon completion of all contract work and submittal of the final update schedule and certification, any remaining retained funds associated with this section, "Progress Schedule (Critical Path Method)", will be released for payment. Retentions held in conformance with this section shall be in addition to other retentions provided for in the contract. No interest will be due the Contractor on retention amounts.

PAYMENT

Progress schedule (critical path method) will be paid for at a lump sum price. The contract lump sum price paid for progress schedule (critical path method) shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals, including computer software, and for doing all the work involved in preparing, furnishing, and updating schedules, and instructing and assisting the Engineer in the use of computer software, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Payments for the progress schedule (critical path method) contract item will be made progressively as follows:

A. A total of 25 percent of the item amount or a total of 25 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon achieving all of the following:

    1. Completion of 5 percent of all contract item work.
    2. Acceptance of all schedules and TIAs required to the time when 5 percent of all contract item work is complete.
    3. Delivery of schedule software to the Engineer.
    4. Completion of required schedule software training.

B. A total of 50 percent of the item amount or a total of 50 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 25 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 25 percent of all contract item work is complete.

C. A total of 75 percent of the item amount or a total of 75 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of 50 percent of all contract item work and acceptance of all schedules and TIAs required to the time when 50 percent of all contract item work is complete.

D. A total of 100 percent of the item amount or a total of 100 percent of the amount listed for progress schedule (critical path method) in "Payments" of Section 5 of these special provisions, whichever is less, will be paid upon completion of all contract item work, acceptance of all schedules and TIAs required to the time when all contract item work is complete, and submittal of the certified final update schedule.

If the Contractor fails to complete any of the work or provide any of the schedules required by this section, the Engineer shall make an adjustment in compensation in conformance with the provisions in Section 4-1.03C, "Changes in Character of Work," of the Standard Specifications for the work not performed. Adjustments in compensation for schedules will not be made for any increased or decreased work ordered by the Engineer in furnishing schedules.

10-1.12 TIME-RELATED OVERHEAD

The Contractor will be compensated for time-related overhead as described below and in conformance with "Force Account Payment" of these special provisions. The Contractor will not be compensated for time-related overhead for delays to the controlling operations caused by the Engineer that occur prior to the first working day, but will be compensated for actual overhead costs incurred, as determined by an independent Certified Public Accountant audit examination and report.

Attention is directed to "Beginning of Work, Time of Completion and Liquidated Damages," "Force Account Payment," and "Progress Schedule (Critical Path Method)" of these special provisions.

The provisions in Section 9-1.08, "Adjustment of Overhead Costs," of the Standard Specifications shall not apply.

Time-related overhead shall consist of those overhead costs, including field and home office overhead, that are in proportion to the time required to complete the work. Time-related overhead shall not include costs that are not related to time, including but not limited to, mobilization, licenses, permits, and other charges incurred only once during the contract. Time-related overhead shall not apply to subcontractors of any tier, suppliers, fabricators, manufacturers, or other parties associated with the Contractor.

Field office overhead expenses include time-related costs associated with the normal and recurring operations of the construction project, and shall not include costs directly attributable to the work of the contract. Time-related costs of field office overhead include, but are not limited to, salaries, benefits, and equipment costs of project managers, general superintendents, field office managers and other field office staff assigned to the project, and rent, utilities, maintenance, security, supplies, and equipment costs of the project field office.

Home office overhead or general and administrative expenses refer to the fixed costs of operating the Contractor's business. These costs include, but are not limited to, general administration, insurance, personnel and subcontract administration, purchasing, accounting, and project engineering and estimating. Home office overhead costs shall exclude expenses specifically related to other contracts or other businesses of the Contractor, equipment coordination, material deliveries, and consultant and legal fees.

The quantity of time-related overhead associated with a reduction in contract time for cost reduction incentive proposals accepted and executed in conformance with the provisions in Section 5-1.14, "Cost Reduction Incentive," of the Standard Specifications shall be considered a construction cost attributable to the resultant estimated net savings due to the cost reduction incentive.

If the final increased quantity of time-related overhead exceeds 149 percent of the number of working days specified in the Engineer's Estimate, the Contractor shall, within 60 days of the Engineer's written request, submit to the Engineer an audit examination and report performed by an independent Certified Public Accountant of the Contractor's actual overhead costs. The audit examination and report shall depict the Contractor's project and company-wide financial records and shall specify the actual overall average daily rates for both field and home office overhead for the entire duration of the project, and whether the costs have been properly allocated. The rates of field and home office overhead shall exclude unallowable costs as determined in the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31.

Independent Certified Public Accountant's audit examinations shall be performed in conformance with the requirements of the American Institute of Certified Public Accountants Attestation Standards. Audit examinations and reports shall determine if the rates of field office overhead and home office overhead are:

A. Allowable in conformance with the requirements of the Federal Acquisition Regulations, 48 CFR, Chapter 1, Part 31.
B. Adequately supported by reliable documentation.
C. Related solely to the project under examination.

Within 20 days of receipt of the Engineer's written request, the Contractor shall make its financial records available for audit by the State for the purpose of verifying the actual rate of time-related overhead specified in the audit submitted by the Contractor. The actual rate of time-related overhead specified in the audit, submitted by the Contractor, will be subject to approval by the Engineer.

If the Engineer requests the independent Certified Public Accountant audit, or if it is requested in writing by the Contractor, the contract item payment rate for time-related overhead, in excess of 149 percent of the number of working days specified in the Engineer's Estimate, will be adjusted to reflect the actual rate.

The cost of performing an independent Certified Public Accountant audit examination and submitting the report, requested by the Engineer, will be borne equally by the State and the Contractor. The division of the cost will be made by determining the cost of providing an audit examination and report in conformance with the provisions of Section 9-1.03B, "Work Performed by Special Forces or Other Special Services," of the Standard Specifications, and paying to the Contractor one-half of that cost. The cost of performing an audit examination and submitting the independent Certified Public Accountant audit report for overhead claims other than for the purpose of verifying the actual rate of time-related overhead shall be entirely borne by the Contractor. The cost of performing an audit examination and submitting the independent Certified Public Accountant audit report to verify actual overhead costs incurred prior to the first working day shall be entirely borne by the Contractor.

The quantity of time-related overhead to be paid will be measured by the working day, designated in the Engineer's Estimate as WDAY. The estimated number of working days is the number of working days, excluding days for plant establishment, as specified in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions. The quantity of time-related overhead will be increased or decreased only as a result of suspensions or adjustments of contract time which revise the current contract completion date, and which satisfy any of the following criteria:

A. Suspensions of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the Standard Specifications, except:

    1. Suspensions ordered due to weather conditions being unfavorable for the suitable prosecution of the controlling operation or operations.
    2. Suspensions ordered due to the failure on the part of the Contractor to carry out orders given, or to perform the provisions of the contract.
    3. Suspensions ordered due to factors beyond the control of and not caused by the State or the Contractor, for which the Contractor is granted extensions of time in conformance with the provisions of the third paragraph of Section 8-1.07, "Liquidated Damages," of the Standard Specifications.
    4. Other suspensions that mutually benefit the State and the Contractor.

B. Extensions of contract time granted by the State in conformance with the provisions in the fifth paragraph in Section 8-1.07, "Liquidated Damages," of the Standard Specifications and set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.
C. Reductions in contract time set forth in approved contract change orders, in conformance with the provisions in Section 4-1.03, "Changes," of the Standard Specifications.

In the event an early completion progress schedule, as defined in "Progress Schedule (Critical Path Method)" of these special provisions, is submitted by the Contractor and approved by the Engineer, the amount of time-related overhead eligible for payment will be based on the total number of working days for the project, in conformance with the provisions in "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, rather than the Contractor's early completion progress schedule.

The contract price paid per working day for time-related overhead shall include full compensation for time-related overhead, including the Contractor's share of costs of the independent Certified Public Accountant audit of overhead costs requested by the Engineer, as specified in these special provisions, and as directed by the Engineer.

The provisions in Sections 4-1.03B, "Increased or Decreased Quantities," and 4-1.03C, "Changes in Character of the Work," of the Standard Specifications shall not apply to the contract item of time-related overhead.

Full compensation for additional overhead costs incurred during days of inclement weather when the contract work is extended into additional construction seasons due to delays caused by the State shall be considered as included in the time-related overhead paid during the contract working days, and no additional compensation will be allowed therefor.

Full compensation for additional overhead costs involved in performing additional contract item work that is not a controlling operation shall be considered as included in the contract items of work involved and no additional compensation will be allowed therefor.

Full compensation for overhead, other than time-related overhead measured and paid for as specified above, and other than overhead costs included in the markups specified in "Force Account Payment" of these special provisions, shall be considered as included in the various items of work and no additional compensation will be allowed therefor.

Overhead costs incurred by subcontractors of any tier, suppliers, fabricators, manufacturers, and other parties associated with the Contractor shall be considered as included in the various items of work and as specified in Section 9-1.03, “Force Account Payment,” of the Standard Specifications.

For the purpose of making partial payments pursuant to the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications, the number of working days to be paid for time-related overhead in each monthly partial payment will be the number of working days, specified above to be measured for payment that occurred during that monthly estimate period, including compensable suspensions and right of way delays. Working days granted by contract change order due to extra work or changes in character of the work, will be paid for upon completion of the contract. The amount earned per working day for time-related overhead shall be the lesser of the following amounts:

A. The contract item price.
B. Twenty percent of the original total contract amount divided by the number of working days specified in "Beginning of Work, Time of Completion and Liquidated Damages," of these special provisions.

After the work has been completed, except plant establishment work, as provided in Section 20-4.08, "Plant Establishment Work," of the Standard Specifications, the amount of the total contract item price for time-related overhead not yet paid will be included for payment in the first estimate made after completion of roadway construction work, in conformance with the provisions in Section 9-1.06, "Partial Payments," of the Standard Specifications.

10-1.13 OBSTRUCTIONS

Attention is directed to Section 8-1.10, "Utility and Non-Highway Facilities," and Section 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer and the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure. Regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	(800) 642-2444 (800) 227-2600
Underground Service Alert-Southern California (USA)	(800) 422-4133 (800) 227-2600

10-1.14 DUST CONTROL

Dust control shall conform to the provisions in Section 10, "Dust Control," of the Standard Specifications.

10-1.15 CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and temporary traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Category 1 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices. These devices shall be certified as crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 temporary traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.

If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 temporary traffic control devices at least 5 days before beginning any work using the devices or within 2 days after the request if the devices are already in use. Self-certification shall be provided by the manufacturer or Contractor and shall include the following:

A. Date,
B. Federal Aid number (if applicable),
C. Contract number, district, county, route and post mile of project limits,
D. Company name of certifying vendor, street address, city, state and zip code,
E. Printed name, signature and title of certifying person; and
F. Category 1 temporary traffic control devices that will be used on the project.

The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices that are not expected to produce significant vehicular velocity change, but may cause potential harm to impacting vehicles. Category 2 temporary traffic control devices include barricades and portable sign supports.

Category 2 temporary traffic control devices shall be on the Federal Highway Administration's (FHWA) list of Acceptable Crashworthy Category 2 Hardware for Work Zones. This list is maintained by FHWA and can be located at:

http://safety.fhwa.dot.gov/roadway_dept/road_hardware/listing.cfm?code=workzone

The Department also maintains this list at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf/Category2.pdf

Category 2 temporary traffic control devices that have not received FHWA acceptance shall not be used. Category 2 temporary traffic control devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer. The label shall be readable and permanently affixed by the manufacturer. Category 2 temporary traffic control devices without a label shall not be used.

If requested by the Engineer, the Contractor shall provide a written list of Category 2 temporary traffic control devices to be used on the project at least 5 days before beginning any work using the devices or within 2 days after the request if the devices are already in use.

Category 3 temporary traffic control devices consist of temporary traffic-handling equipment and devices that weigh 100 pounds or more and are expected to produce significant vehicular velocity change to impacting vehicles. Temporary traffic-handling equipment and devices include crash cushions, truck-mounted attenuators, temporary railing, temporary barrier, and end treatments for temporary railing and barrier.

Type III barricades may be used as sign supports if the barricades have been successfully crash tested, meeting the NCHRP Report 350 criteria, as one unit with a construction area sign attached.

Category 3 temporary traffic control devices shall be shown on the plans or on the Department's Highway Safety Features list. This list is maintained by the Division of Engineering Services and can be found at:

http://www.dot.ca.gov/hq/esc/approved_products_list/HighwaySafe.htm

Category 3 temporary traffic control devices that are not shown on the plans or not listed on the Department's Highway Safety Features list shall not be used.

Full compensation for providing self-certification for crashworthiness of Category 1 temporary traffic control devices and for providing a list of Category 2 temporary traffic control devices used on the project shall be considered as included in the prices paid for the various items of work requiring the use of the Category 1 or Category 2 temporary traffic control devices and no additional compensation will be allowed therefor.

10-1.16 CONSTRUCTION AREA SIGNS

Construction area signs for temporary traffic control shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications and these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels. Type III, IV, VII, VIII, or IX retroreflective sheeting shall be used for stationary mounted construction area sign panels.

Unless otherwise shown on the plans or specified in these special provisions, the color of construction area warning and guide signs shall have black legend and border on orange background, except W10-1 or W47(CA) (Highway-Rail Grade Crossing Advance Warning) sign shall have black legend and border on yellow background.

Orange background on construction area signs shall be fluorescent orange.

Repair to construction area sign panels will not be allowed, except when approved by the Engineer. At nighttime under vehicular headlight illumination, sign panels that exhibit irregular luminance, shadowing or dark blotches shall be immediately replaced at the Contractor's expense.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 working days, but not more than 14 calendar days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert-Northern California (USA)	(800) 642-2444 (800) 227-2600
Underground Service Alert-Southern California (USA)	(800) 422-4133 (800) 227-2600

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes. The post hole diameter, if backfilled with portland cement concrete, shall be at least 4 inches greater than the longer dimension of the post cross section.

Construction area signs placed within 15 feet from the edge of the travel way shall be mounted on stationary mounted sign supports as specified in "Construction Area Traffic Control Devices" of these special provisions.

The Contractor shall maintain accurate information on construction area signs. Signs that are no longer required shall be immediately covered or removed. Signs that convey inaccurate information shall be immediately replaced or the information shall be corrected. Covers shall be replaced when they no longer cover the signs properly. The Contractor shall immediately restore to the original position and location any sign that is displaced or overturned, from any cause, during the progress of work.

10-1.17 MAINTAINING TRAFFIC

Maintaining traffic shall conform to the provisions in Sections 7-1.08, "Public Convenience," Section 7-1.09, "Public Safety," and Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, "Public Safety" of these special provisions and these special provisions.

Closure is defined as the closure of a traffic lane or lanes, including shoulder, within a single traffic control system.

Closures shall conform to the provisions in "Traffic Control System for Lane Closure" of these special provisions.

Closures are only allowed during the hours shown in the lane requirement charts included in this section "Maintaining Traffic," except for work required under Sections 7-1.08, "Public Convenience," and Section 7-1.09, "Public Safety."

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

Local authorities shall be notified at least 5 business days before work begins. The Contractor shall cooperate with local authorities to handle traffic through the work area and shall make arrangements to keep the work area clear of parked vehicles.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders including sections closed to public traffic.

When work vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane, the shoulder area shall be closed with fluorescent orange traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment and along the edge of the pavement at 25-foot intervals to a point not less than 25 feet past the last vehicle or piece of equipment. A minimum of 9 traffic cones or portable delineators shall be used for the taper. A W20-1 (ROAD WORK AHEAD) or W21-5b (RIGHT/LEFT SHOULDER CLOSED AHEAD) or C24(CA) (SHOULDER WORK AHEAD) sign shall be mounted on a crashworthy portable sign support with flags. The sign shall be placed where designated by the Engineer. The sign shall be a minimum of 48" x 48" in size. The Contractor shall immediately restore to the original position and location a traffic cone or delineator that is displaced or overturned, during the progress of work.

A minimum of one paved traffic lane, not less than 12 feet wide, shall be open for use by public traffic.

If minor deviations from the lane requirement charts are required, a written request shall be submitted to the Engineer at least 15 days before the proposed date of the closure. The Engineer may approve the deviations if there is no significant increase in the cost to the State and if the work can be expedited and better serve the public traffic.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Special Days are Martin Luther King Day, Lincoln's Birthday, Friday through Easter Sunday, Cesar Chavez Day, Columbus Day and December 26th through December 31st. No closure is allowed on these days.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the C43(CA), SC6-3(CA), SC6-4(CA), W20-1, W21-5b, and C24(CA) signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

District 8 Special Events List

No work that encroaches onto the traveled way of the affected Routes shall be allowed from 3 hours before to 2 hours following special events listed below unless otherwise permitted by the District Traffic Manager

Venue/Special Event	Affected Routes	Route Impact	Route Limits	Presently Identified The Month Of Events	Website	Contact #
Glen Helen Hyundai Pavilion	215 15	*** **	University Pkwy to I-15/215 connector I-60 to Devore Road	Various events May-Oct yearly See web site	www.hyundaipavilion.com	909-495-3608
Route 66 Rendezvous	215	**	Mill St. to 5th St	September	www.route-66.org	909-889-3980
California Speedway	10 15 210 66 60	*** *** *** *** ***	LA I-57 to SBD I-215 I-15/215 to SR-91 Haven to I-215 Haven to Cherry I-15 to County Line	Various events Through the year See web site	www.californiaspeedway.com	909-429-5000
Temecula Balloon and Wine Festival	15	**	SR-79 (Winchester Rd.) and Rancho California	June	www.tvbwf.com	951-676-6713
Bob Hope/Chrysler Classic	10	**	Palm Springs off ramp at SR-111	January	www.bhcc.com	760-346-6329
Kraft Nabisco Championship	10	**	Palm Springs off ramp at SR-111	March	www.nabiscochampionship.com	760-324-4546
Festival of Lights (Downtown Riverside)	91	* *	I-15 to I-215/SR-60 split	November	http://www.riversidedowntown.org/html/htmlpages/RDP_YearlyEvents.htm	951-683-7100
Orange Blossom Festival	91	**	I-15 to I-215/SR-60 split	May	wwwobfa.org	951-715-3400
March Air Show March Air Reserve Base	215	***	Cactus to Ramona Express Way	April	No website	951-655-1110
UCR Graduation	60 215	*** ***	I-215/SR-60/SR-91 split to Central Ave.	June	www.commencement.ucr.edu	951-787-3144
Laughlin River Run	40	***	I-40/ From I-15 to Arizona State Line	April	http://www.laughlinriverrun.com/	949-502-3434

Note: The dates of events change yearly. Contact numbers and websites provided to verify exact dates

** Designates-Moderate Impact (20 minute delay or less)
*** Designates-High Impact (30 minute delay or less)

Lane Closure Restriction for Designated Legal Holidays and Special Days

Thu	Fri	Sat	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Sun
x	**H** xx	xx	xx							
	SD xx									
x	xx	**H** xx	xx							
		SD xx								
	x	xx	**H** xx	xx						
			SD xx							
	x	xx	xx	**H** xx						
	x	xx	xx	**SD** xx						
				x	**H** xx					
				x	**SD** xx					
					x	**H** xx				
						SD xx				
						x	**H** xx	xx		xx
							SD xx			

Legends:

	Refer to lane closure charts
x	The full width of the traveled way shall be open for use by public traffic after 6 pm.
xx	The full width of the traveled way shall be open for use by public traffic.
H	Designated Legal Holiday
SD	Special Day

Chart No. 1
EA 08-0H2824
Conventional Highway Lane Requirements

County: SBd	Route/Direction: Victoria St./EB	PM: N/A

Closure Limits: East Avenue to Cherry Avenue

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Fridays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Saturdays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Sundays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	

Legend:

1	Provide at least one through traffic lane open in direction of travel
R	Provide at least one through traffic lane, not less than 10 feet in width, for use by both directions of travel (Reversing Control)

REMARKS:

Chart No. 2
EA 08-0H2824
Conventional Highway Lane Requirements

County: SBd	Route/Direction: Victoria St./WB	PM: N/A

Closure Limits: East Avenue to Cherry Avenue

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Fridays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Saturdays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	
Sundays	R	R	R	R	R	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	R	R	R	

Legend:

1	Provide at least one through traffic lane open in direction of travel
R	Provide at least one through traffic lane, not less than 10 feet in width, for use by both directions of travel (Reversing Control)

REMARKS:

10-1.18 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system shall consist of closing traffic lanes in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.

The provisions in this section will not relieve the Contractor from the responsibility to provide additional devices or take measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

When lane closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations designated by the Engineer within the limits of the highway right of way.

One-way traffic shall be controlled through the project in conformance with the plan entitled "Traffic Control System for Lane Closure on Two Lane Conventional Highways" and these special provisions.

Additional advance flaggers will be required.

When traffic is under one-way control on unpaved areas, the cones shown along the centerline on the plans need not be placed.

Utilizing a pilot car will be at the option of the Contractor. If the Contractor elects to use a pilot car, the cones shown along the centerline on the plan need not be placed. The pilot car shall have radio contact with personnel in the work area. The maximum speed of the pilot car through the traffic control zone shall be 25 miles per hour.

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor (except for flagging costs), materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing, and disposing of the components of the traffic control system and for furnishing and operating the pilot car, (including driver, radios, other equipment, and labor required), as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer. Flagging costs will be paid for as provided in Section 12-2.02, "Flagging Costs," of the Standard Specifications.

The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.

Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.19 TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety", "Order of Work", and "Temporary Railing" of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 15 feet or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

1. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:

1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734

1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672, telephone (949) 361-5663, FAX (949) 361-9205

2.1. Northern California: United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112, telephone (408) 287-4303, FAX (408) 287-1929

2.2. Southern California: Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448, telephone (800) 559-7080, FAX (805) 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.

Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in pounds for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.

Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.

Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement.

A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.

At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.

Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions will not be measured nor paid for.

10-1.20 EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the Standard Specifications.

10-1.21 WATERING

Developing a water supply and applying watering shall conform to the provisions in Section 17, "Watering," of the Standard Specifications and these special provisions.

DEVELOP WATER SUPPLY

The Contractor shall make the arrangements for furnishing and applying water and shall pay all costs involved until acceptance of the contract.

The Cucamonga Valley Water District has established a rate of $1.26 per 100 cu. ft. for supplying water and an additional "SERVICE CHARGE" of $105.50 every 2 months for each 2" water meter. If at any time, until acceptance of the contract, these rates have been changed, the State will take a credit for the reduction in the rate, or the State will pay the difference for the increase in the rate. The credit or payment will be taken or paid on each subsequent estimate period after the water meter is installed and shall cover the use of water for the previous estimate period’s use of water. The Contractor shall furnish the Engineer with a copy of each monthly invoice for the water use.

The Contractor shall make the necessary arrangements to assign the water billings to the State upon the date of acceptance of the contract.

The contract unit price paid for develop water supply shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work in furnishing water and no additional compensation will be allowed therefore.

10-1.22 EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

10-1.23 SITE GRADING

GENERAL

Scope: This work shall consist of grading the site in accordance with the provisions in Earthwork" of these special provisions, the details shown on the plans and these special provisions.

Site grading shall consist of excavation or removal of above grade material regardless of character and subsurface condition; filling of all holes, swales, embankments, and low points to the elevation shown on the plans or specified; and the preparation of basement material for the placing of other material thereon and the establishment of the grading plane.

MATERIALS

Fill Material: Material from the excavation that is suitable for the required compaction may be used for filling holes, swales and low points. Fill material shall be free of organic material. Rocks and lumps shall be well distributed with sufficient earth or other fine matrix material to produce a dense, compacted fill that is suitable for the construction and load support intended.

EXECUTION

EXCAVATION

Care shall be exercised to avoid disturbing material below and beyond the limits of excavation. When excavation is carried beyond the limits shown on the plans or specified, such excavation shall be replaced in kind and compacted at the Contractor's expense.

Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Excess and waste materials from the excavation shall become the property of the Contractor and be disposed of outside the State property in accordance with the requirements in Section 7-1.13 of the Standard Specifications.

FILL

Subgrade Preparation: Preparation of subgrade material for placing other material thereon shall include fine grading, compaction, reworking as necessary, and preparation of cut, or fill upon which base materials, surfacing, or slabs are to be placed. The upper 8 inches of the subgrade shall have the same compaction as the fill to be placed over it.

Placing: When footings are to be constructed in fill, the fill shall be constructed to the grading plane required for the building construction prior to excavating for the footings. Fill shall be placed and compacted in layers. The loose thickness of each layer before compaction shall not exceed 6 inches.

Water shall be added to the fill material as needed for compaction.

COMPACTION

Relative compaction shall be determined in accordance with California Test 216 or 231. 22

Relative Compaction (95 percent):

In fill relative compaction of not less than 95 percent shall be obtained for a minimum depth of 2.5 feet below finished grade for the width of the paved areas plus 3 feet on each side thereof.

The prisim of fill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

Relative Compaction (90 percent): Relative compaction of not less than 90 percent shall be obtained in all fill except as specified above.

FIELD QUALITY CONTROL

Testing and Inspection: The State will conduct compaction tests during the earthwork operations.

MEASUREMENT AND PAYMENT

Site grading will be measured and paid for by the square yard. The quantity of site grading to be paid for by the square yard will be calculated on the basis of computed slope measurements.

The contract price paid per square yard for site grading shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in performing site grading work completely as shown on the plans, including disposal of surplus site grading materials, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Surplus excavated material shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Where a portion of the existing surfacing is to be removed, the outline of the area to be removed shall be cut on a neat line with a power-driven saw to a minimum depth of 0.17-foot before removing the surfacing. Full compensation for cutting the existing surfacing shall be considered as included in the contract price paid per cubic yard for roadway excavation and no additional compensation will be allowed therefor.

Reinforcement or metal attached to reinforced concrete rubble placed in embankments shall not protrude above the grading plane. Prior to placement within 2 feet below the grading plane of embankments, reinforcement or metal shall be trimmed to no greater than 3/4 inch from the face of reinforced concrete rubble. Full compensation for trimming reinforcement or metal shall be considered as included in the contract price paid for site grading and no additional compensation will be allowed therefor.

10-1.24 CONTROLLED LOW STRENGTH MATERIAL

Controlled low strength material shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions.

At the option of the Contractor, controlled low strength material may be used as structure backfill for pipe culverts, except that controlled low strength material shall not be used as structure backfill for culverts having a diameter or span greater than 20 feet.

When controlled low strength material is used for structure backfill, the width of the excavation shown on the plans may be reduced so that the clear distance between the outside of the pipe and the side of the excavation, on each side of the pipe, is a minimum of 12 inches. This minimum may be reduced to 6 inches when the height of cover is less than or equal to 20 feet or the pipe diameter or span is less than 42 inches.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. For trenches in existing pavements, permanent placement shall be no higher than the bottom of the existing pavement permeable drainage layer. If a drainage layer does not exist, permanent placement in existing pavements shall be no higher than one inch below the bottom of the existing asphalt concrete surfacing or no higher than the top of base below the existing portland cement concrete pavement. The minimum height that controlled low strength material shall be placed, relative to the culvert invert, is 0.5 diameter or 0.5 height for rigid culverts and 0.7 diameter or 0.7 height for flexible culverts.

When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 50 pounds per square inch and 100 pounds per square inch for pipe culverts having a height of cover of 20 feet or less and a minimum 28-day compressive strength of 100 pounds per square inch for pipe culverts having a height of cover greater than 20 feet. Compressive strength shall be determined in conformance with the requirements in ASTM Designation: D 4832.
B. Cement shall be any type of portland cement conforming to the requirements in ASTM Designation: C 150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation: C 595M or the physical requirements in ASTM Designation: C 1157M. Testing of cement will not be required.
C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," of the Standard Specifications. Chemical admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

Materials for controlled low strength material shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates.

When controlled low strength material is to be placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a maximum indentation diameter of 3 inches prior to covering and opening to public traffic. Penetration resistance shall be measured in conformance with the requirements in ASTM Designation: D 6024.

Controlled low strength material used as structure backfill for pipe culverts will be considered structure backfill for compensation purposes.

10-1.25 IRRIGATION SLEEVE

Irrigation sleeves shall be polyvinyl chloride (PVC) plastic pipe and shall conform to the provisions in Section 20-2.15B(1), "Plastic Pipe Supply Line," of the Standard Specifications and these special provisions.

Irrigation sleeves shall be 6 inches in diameter and shall have a pressure rating (PR) 315.

Fittings shall be Schedule 40.

Irrigation sleeves shall be installed where shown on the plans.

Irrigation sleeves shall be installed not less than 1.5 feet below finished grade measured to the top of the sleeve. Sleeves shall extend 6 inches beyond paving. The ends of the sleeve shall be capped until use.

Quantities of irrigation sleeve to be paid will be determined from the slope length designated by the Engineer. Irrigation sleeve placed in excess of the lengths designated will not be paid for.

The contract price paid per linear foot for irrigation sleeve shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in irrigation sleeve, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.26 IMPORTED TOPSOIL

Imported topsoil shall conform to the provisions in Section 20-2, "Materials," and Section 20-3, "Erosion Control," of the Standard Specifications.

10-1.27 DECOMPOSED GRANITE

Decomposed granite work shall consist of furnishing, stabilizing, and placing decomposed granite, including site preparation and edging, as shown on the plans and in conformance with these special provisions, and as directed by the Engineer.

MATERIALS

Decomposed Granite

Decomposed granite shall be ¾" minus material and shall conform to the following:

Grading Requirements (AASHTO T11-82 and T27-82)

Sieve Size	Percent Passing
3/8"	100
3/16"	95-100
3/32"	75-80
3/64"	55-65
1/32"	40-50
1/64"	25-35
1/128"	20-25
1/256"	5-15

The color of decomposed granite shall match the Federal Standard 595a color number 20045.

The Contractor shall submit a 5 lb. sample of decomposed granite to the Engineer for approval prior to delivery of materials to the site.

Landscape Fabric

Landscape fabric shall be manufactured from thermally spun bonded polypropylene fabric and shall conform to the following:

Specification	Minimum Requirement
Grab Tensile Strength	139lbs
Grab Elongation	60%
UV Resistance	70% @ 150 hours
Mass	4oz/square yard

A copy of the manufacturer's product sheet together with instructions for installation shall be furnished to the Engineer 5 days before installation.

Staples

Staples shall be 2" wide, 8" in length, and 11 gauge wire.

Solidifying Emulsion

Solidifying emulsion shall be either a water-based polymer, or organic powdered binder specifically manufactured to harden decomposed granite. The solidifying emulsion shall not alter the decomposed granite color. A copy of the manufacturer's product sheets together with instructions for application shall be furnished to the Engineer 5 days before application.

A Certificate of Compliance for the solidifying emulsion shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Edging

Edging shall be commercial quality, made of aluminum, and have an L-shape design. Edging shall be a minimum 4" in height. Thickness shall be as recommended by the manufacturer for commercial installation of the use intended. Edging shall be anchored with steel spikes or stakes, whichever is provided by the manufacturer of the edging. Spike or stake size and spacing shall be per edging manufacturer's specifications for use and site conditions. A copy of the manufacturer's product sheets together with instructions for installation shall be furnished to the Engineer 5 days before application.

TEST PLOT

Decomposed granite for the permanent work shall not be placed on the project prior to approval by the Engineer of a test plot prepared by the Contractor. The Contractor shall construct a test plot at least 1 yard by 4 yards at the site of the same materials proposed for the permanent work.

SITE PREPARATION

Clearing

Prior to decomposed granite installation, the areas shall be graded as specified under "Site Grading" in these special provisions.

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the Standard Specifications and these special provisions.

After clearing, areas to receive weed barrier shall be excavated. Where weed barrier is to be placed adjacent to an existing curb or dike, the subgrade shall be excavated such that the finished weed barrier elevation adjacent to curb or dike will maintain planned flow lines, slope gradient and contours of the project site. After excavation, areas to receive weed barrier shall be graded to a smooth, uniform surface and compacted to not less than 90% relative compaction.

Surplus excavated material shall become the property of the Contractor and shall be disposed of outside the highway right of way in conformance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Soil Treatment

Following excavation and compaction, the subbase for decomposed granite shall be treated with Dichlobenil in conformance with Section 20-4.026, "Pesticides," of the Standard Specifications and the manufacturer's recommendations. Pesticides shall not be applied more than 12"beyond areas to receive decomposed granite.

Immediately prior to treatment, the subbase shall be scarified to a minimum depth of 3" and rocks, large lumps of earth, weeds, and other debris shall be removed and disposed of. Removed material shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. The loosened material shall then be brought to as finely divided condition as the material will permit.

After scarification, the soil shall be sterilized with Dichlobenil. applied at the maximum label rate unless otherwise directed by the Engineer.

Pesticides shall be mixed in conformance with the manufacturer's recommendations and shall be applied by a device approved by the Engineer. Pesticides shall not be applied more than 8 hours prior to placing asphalt concrete surfacing. Pesticides shall not be applied more than 12" beyond the areas to be surfaced.

Prior to placement of decomposed granite, the soil surface shall be smooth, firm stable and free of rocks, clods, foliage, roots or other material greater than 1" in diameter.

PLACEMENT

Landscape fabric shall be placed in areas to receive decomposed granite as recommended by the manufacturer and as specified in these special provisions. Landscape fabric shall be placed loosely with longitudinal and transverse joints overlapped 4" and stapled to the subgrade at 6" on center. Staples shall be driven perpendicular to the ground surface. Following placement, the fabric shall lay flat, smooth and be in uniform contact with the soil surface, without bulges or wrinkles.

Edging shall be installed to delineate the limits of the decomposed granite areas as shown on the plans and as specified in these special provisions. Edging will not be required between decomposed granite areas and the adjacent face of soundwalls, pavement edges, or rock blanket areas.

Solidifying emulsion shall be thoroughly and uniformly mixed throughout the decomposed granite per the manufacturer's recommendations. Material shall be mixed in the field using portable mixing equipment, or delivered in mixer trucks from a local ready-mixed plant. Decomposed granite shall be placed in two 1-1/2" layers.

Each layer of decomposed granite shall be raked to evenly blend various material, sizes forming a smooth uniform surface. Decomposed granite shall be moistened sufficiently to obtain the required compaction. Each layer of decomposed granite shall be brought to a relative compaction of not less than 90 percent by compaction equipment such as a double drum roller, single drum roller, or vibratory tamp. After placement of decomposed granite, compaction shall not begin less than 6 hours after placement, nor later than 48 hours.

Decomposed granite areas shall receive a final application of solidifying emulsion as recommended by the manufacturer. The Contractor shall prevent runoff or overspray of solidifying emulsion onto adjacent paved or planting areas.

When work is complete, the surface shall be smooth and uniform; maintaining original flow lines, slope gradient and contours of the project site.

Every 365 days after installation, a dilute topcoat of solidifying emulsion shall be applied at the same rate as the final application at installation, or as otherwise recommended by the manufacturer.

If the top surface of the decomposed granite has in excess of ¼"of loose aggregate, the loose material shall be redistributed evenly over the surface. These decomposed granite areas shall be moistened to a depth of 1" and compacted with a 1200 lb. power roller. A diluted top coat of solidifying emulsion shall be applied at the same rate used for the final application at installation or as recommended by the manufacturer.

If cracks develop in the surface of the decomposed granite, loose fines shall be swept into the cracks, watered thoroughly and hand tamped. A final top coat of solidifying emulsion shall be applied at the same rate used for the final application at installation or as recommended by the manufacturer.

MEASUREMENT

Decomposed granite will be measured by the cubic yard as determined from actual measurements made parallel to the ground slope.

PAYMENT

The contract price paid per cubic yard for decomposed granite shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in decomposed granite, complete in place, including landscape fabric, staples, solidifying emulsion, edging, soil treatment, and test plot, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.28 AGGREGATE BASE

Aggregate base must comply with Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.

Aggregate base must be Class 2.

Do not store reclaimed asphalt concrete or aggregate base with reclaimed asphalt concrete within 100 feet measured horizontally of any culvert, watercourse, or bridge.

10-1.29 ASPHALT CONCRETE

GENERAL

Asphalt concrete shall be Type A and shall conform to the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The grade of asphalt binder to be mixed with aggregate for Type A asphalt concrete shall be Grade PG 64-10 conforming to the provisions in Section 92, "Asphalts," of the Standard Specifications.

The asphalt content of the asphalt mixture will be determined in conformance with the requirements in California Test 379, or in conformance with the requirements in California Test 382.

The aggregate for Type ___ asphalt concrete shall be lime treated in conformance with "Lime Treated Aggregates" of these special provisions.

RECLAIMED ASPHALT PAVEMENT

The Contractor may produce asphalt concrete Type A and Type B using reclaimed asphalt pavement (RAP). Asphalt concrete produced using RAP shall conform to the provisions for asphalt concrete in this section, "Asphalt Concrete," and these special provisions. The Contractor may substitute RAP for a portion of the virgin aggregate in asphalt concrete in an amount not exceeding 15 percent of the asphalt concrete dry aggregate mass.

RAP shall be processed from asphalt concrete removed from pavement surfaces. RAP shall be stored in stockpiles on smooth surfaces free of debris and organic material. RAP stockpiles shall consist only of homogeneous RAP. The Contractor may process and stockpile RAP throughout the project's life. Processing and stockpiling operations shall prevent material contamination and segregation.

The Contractor shall determine the amount of asphalt binder to be mixed with the combined virgin aggregate and RAP in conformance with the requirements in California Test 367 amended by Lab Procedure-9 (LP-9), "Hot Mix Asphalt (HMA) Using Up To 15% Reclaimed Asphalt Pavement (RAP)." LP-9 is available at:

http://www.dot.ca.gov/hq/esc/Translab/fpmlab.htm

At least 20 days before starting production of asphalt concrete using RAP, the Contractor shall submit a proposed asphalt concrete mix design in writing to the Engineer. The mix design submittal shall consist of the following:

A. RAP:

1. Processed stockpile locations.
2. LP-9 test results.
3. Correlation factor for aggregate gradations from California Test 382 and LP-9.
4. Three 70-pound samples of processed RAP representing the material to be used. The three samples shall be split from the sample the Contractor uses to determine the mix design. The Contractor shall obtain and split the samples in conformance with the requirements in California Test 125 and LP-9.
5. The substitution rate for virgin aggregate and percent RAP.

B. Virgin aggregate and supplemental fine aggregate blend:

1. Percent passing values for each sieve size.
2. Aggregate quality tests results.
3. Each aggregate source to be used including producer, location, and California Mine Identification number.
4. Percentage of each aggregate stockpile, cold feed, and hot bin to be used.
5. Gradation of each aggregate stockpile, cold feed, and hot bin to be used.

C. Asphalt binder:

1. Source.
2. Material Safety Data Sheets.

D. Antistrip additives**,** if used:

1. Name of product.
2. Name of manufacturer.
3. Manufacturer's designation and proposed rate.
4. Location and method of addition.
5. Material Safety Data Sheets.

E. Asphalt concrete:

1. A completed mix design that reflects the percent of RAP to be used including the electronic worksheet identified in LP-9.
2. In graphical format, stability and air voids versus asphalt binder percentage of asphalt in conformance with the requirements in CTM 367.

Asphalt concrete production using RAP shall not begin until the Engineer approves the mix design. If the Engineer fails to review the mix design in 20 days, and if, in the opinion of the Engineer, work completion is delayed as a result of the failure to review, the Engineer will adjust payment and contract time in conformance with the requirements in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

If proposing a change in the RAP substitution rate, the Contractor shall notify the Engineer. If the substitution rate changes more than 5 percent by dry aggregate mass in the asphalt concrete mixture, the Contractor shall submit a new mix design.

The aggregate gradation for the asphalt concrete produced with RAP shall be calculated based on the mathematical combination of the virgin aggregate gradation during production and the daily RAP gradation. RAP shall be sampled and gradation shall be determined in conformance with the requirements in LP-9. RAP gradations shall be:

A. Determined daily by the Contractor.
B. Used for the mathematical combination of that day's asphalt concrete production.
C. Reported to the Engineer.

The Contractor shall perform quality control testing of the RAP source each day asphalt concrete using RAP is produced.

The Contractor shall perform quality control testing of the aggregates and the asphalt concrete mixture at least once for every 1,000 tons of asphalt concrete using RAP produced, but not less than 2 tests per day.

Daily, the Contractor shall submit to the Engineer:

A. Results for RAP gradation and the asphalt binder content in RAP determined in conformance with the requirements in LP-9.
B. Mathematical calculation of the gradation of the virgin aggregate and RAP aggregate blend.
C. Correlation factor for RAP burn-off determined in conformance with the requirements in LP-9.

RAP proportioning shall conform to the provisions for aggregate proportioning specified in Section 39-3.03, "Proportioning," of the Standard Specifications and these special provisions. The Contractor's mixing equipment shall have a device that safely provides a sample representative of the virgin aggregate and RAP incorporated into the asphalt concrete. The Contractor shall sample in conformance with the requirements in California Test 125 and LP-9.

The temperature of asphalt concrete using RAP shall not exceed 330° F.

If batch mixing is used, RAP shall be kept separate from the virgin aggregate until both ingredients enter the weighhopper or pugmill. After introduction to the pugmill and before asphalt binder is added, the mixing time for the virgin aggregate and RAP shall not be less than 5 seconds. After asphalt binder is added, the mixing time shall not be less than 30 seconds.

If continuous mixing is used, the RAP shall be protected from direct contact with the burner flame with a device such as a shield, separator, or second drum.

PAINT BINDER (TACK COAT)

Paint binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer.

Paint binder (tack coat) shall be, at the option of the Contractor, either slow-setting asphaltic emulsion, rapid-setting asphaltic emulsion. Slow-setting asphaltic emulsion and rapid-setting asphaltic emulsion shall conform to the provisions in Section 39-4.02, "Prime Coat and Paint Binder (Tack Coat)," and the provisions in Section 94, "Asphaltic Emulsions," of the Standard Specifications.

Paint binder (tack coat) shall be applied in the gallon per square yard range limits specified for the surfaces to receive asphalt concrete in the tables below. The exact application rate within the range will be determined by the Engineer.

Application Rates for Asphaltic Emulsion Paint Binder (Tack Coat) on Asphalt Concrete (except Open Graded) and on Portland Cement Concrete Pavement (PCCP)		
Type of surface to receive paint binder (tack coat)	Slow-Setting Asphaltic Emulsion gal/sq yd (Note A)	Rapid-Setting Asphaltic Emulsion gal/sq yd (Note B)
Dense, compact surfaces, between layers, and on PCCP	0.04 - 0.08	0.02 - 0.04
Open textured, or dry, aged surfaces	0.08 - 0.20	0.04 - 0.09

Note A: Slow-setting asphaltic emulsion is asphaltic emulsion diluted with additional water. Water shall be added and mixed with the asphaltic emulsion (containing up to 43 percent water) so the resulting mixture contains one part asphaltic emulsion and not more than one part added water. The water shall be added by the emulsion producer or at a facility that has the capability to mix or agitate the combined blend.

Note B: Undiluted rapid-setting asphaltic emulsion.

When asphaltic emulsion is used as paint binder (tack coat), asphalt concrete shall not be placed until the applied asphaltic emulsion has completely changed color from brown to black.

10-1.30 PILING

GENERAL

Piling shall conform to the provisions in Section 49, "Piling," of the Standard Specifications, and these special provisions.

Unless otherwise specified, welding of any work performed in conformance with the provisions in Section 49, "Piling," of the Standard Specifications, shall be in conformance with the requirements in AWS D1.1.

Attention is directed to "Welding"of these special provisions.

Difficult pile installation is anticipated due to the presence of caving soils.

CAST-IN-DRILLED-HOLE CONCRETE PILES

Cast-in-drilled-hole concrete piling shall conform to the provisions in Section 49-4, "Cast-In-Place Concrete Piles," of the Standard Specifications and these special provisions.

Cast-in-drilled-hole concrete piles 24 inches in diameter or larger may be constructed by excavation and depositing concrete under slurry.

Materials

Concrete deposited under slurry shall have a nominal penetration equal to or greater than 3-1/2 inches. Concrete shall be proportioned to prevent excessive bleed water and segregation.

Concrete deposited under slurry shall contain not less than 675 pounds of cementitious material per cubic yard.

The combined aggregate grading used in concrete for cast-in-drilled-hole concrete piling shall be either the one-inch maximum grading, the 1/2-inch maximum grading, or the 3/8-inch maximum grading and shall conform to the requirements in Section 90-3, "Aggregate Gradings," of the Standard Specifications.

Portions of cast-in-drilled-hole concrete piles shown on the plans to be formed shall be formed and finished in conformance with the provisions for concrete structures in Section 51, "Concrete Structures," of the Standard Specifications.

Mineral Slurry

Mineral slurry shall be mixed and thoroughly hydrated in slurry tanks, and slurry shall be sampled from the slurry tanks and tested before placement in the drilled hole.

Slurry shall be recirculated or continuously agitated in the drilled hole to maintain the specified properties.

Recirculation shall include removal of drill cuttings from the slurry before discharging the slurry back into the drilled hole. When recirculation is used, the slurry shall be sampled and tested at least every 2 hours after beginning its use until tests show that the samples taken from the slurry tank and from near the bottom of the hole have consistent specified properties. Subsequently, slurry shall be sampled at least twice per shift as long as the specified properties remain consistent.

Slurry that is not recirculated in the drilled hole shall be sampled and tested at least every 2 hours after beginning its use. The slurry shall be sampled mid-height and near the bottom of the hole. Slurry shall be recirculated when tests show that the samples taken from mid-height and near the bottom of the hole do not have consistent specified properties.

Slurry shall also be sampled and tested before final cleaning of the bottom of the hole and again just before placing concrete. Samples shall be taken from mid-height and near the bottom of the hole. Cleaning of the bottom of the hole and placement of the concrete shall not start until tests show that the samples taken from mid-height and near the bottom of the hole have consistent specified properties.

Mineral slurry shall be tested for conformance to the requirements shown in the following table:

MINERAL SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before placement in the drilled hole - during drilling - before final cleaning - immediately before placing concrete	64.3* to 69.1* 64.3* to 75.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) bentonite attapulgite	28 to 50 28 to 40	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning - immediately before placing concrete	less than or equal to 4.0	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Any caked slurry on the sides or bottom of hole shall be removed before placing reinforcement. If concrete is not placed immediately after placing reinforcement, the reinforcement shall be removed and cleaned of slurry, the sides of the drilled hole cleaned of caked slurry, and the reinforcement again placed in the hole for concrete placement.

Synthetic Slurry

Synthetic slurries shall be used in conformance with the manufacturer's recommendations and these special provisions. The following synthetic slurries may be used:

PRODUCT	MANUFACTURER
SlurryPro CDP	KB Technologies Ltd. 3648 FM 1960 West Suite 107 Houston, TX 77068 (800) 525-5237
Super Mud	PDS Company c/o Champion Equipment Company 8140 East Rosecrans Ave. Paramount, CA 90723 (562) 634-8180
Shore Pac GCV	CETCO Drilling Products Group 1350 West Shure Drive Arlington Heights, IL 60004 (847) 392-5800
Novagel Polymer	Geo-Tech Drilling Fluids 220 N. Zapata Hwy, Suite 11A Laredo, TX 78043 (210) 587-4758

Inclusion of a synthetic slurry on the above list may be obtained by meeting the Department's requirements for synthetic slurries. The requirements can be obtained from the Offices of Structures Design, P.O. Box 168041, MS# 9-4/11G, Sacramento, CA 95816-8041.

Synthetic slurries listed may not be appropriate for a given site.

Synthetic slurries shall not be used in holes drilled in primarily soft or very soft cohesive soils as determined by the Engineer.

A manufacturer's representative, as approved by the Engineer, shall provide technical assistance for the use of their product, shall be at the site before introduction of the synthetic slurry into a drilled hole, and shall remain at the site until released by the Engineer.

Synthetic slurries shall be sampled and tested at both mid-height and near the bottom of the drilled hole. Samples shall be taken and tested during drilling as necessary to verify the control of the properties of the slurry. Samples shall be taken and tested when drilling is complete, but before final cleaning of the bottom of the hole. When samples are in conformance with the requirements shown in the following tables for each slurry product, the bottom of the hole shall be cleaned and any loose or settled material removed. Samples shall be obtained and tested after final cleaning and immediately before placing concrete.

SlurryPro CDP synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SLURRYPRO CDP KB Technologies Ltd.		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - during drilling - before final cleaning - just before placing concrete	 less than or equal to 67.0* less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling -before final cleaning - just before placing concrete	 50 to 120 less than or equal to 70	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	6 to 11.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning - just before placing concrete	 less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Super Mud synthetic slurries shall be tested for conformance to the requirements shown in the following table:

SUPER MUD PDS Company		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before final cleaning - just before placing concrete	less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling - before final cleaning - just before placing concrete	32 to 60 less than or equal to 60	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8 to 10.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning -just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Shore Pac GCV synthetic slurries shall be tested for conformance to the requirements shown in the following table:

Shore Pac GCV CETCO Drilling Products Group		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before final cleaning - just before placing concrete	less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling - before final cleaning - just before placing concrete	33 to 74 less than or equal to 57	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	8.0 to 11.0	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning -just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Novagel Polymer synthetic slurries shall be tested for conformance to the requirements shown in the following table:

NOVAGEL POLYMER Geo-Tech Drilling Fluids		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - during drilling - before final cleaning - just before placing concrete	 less than or equal to 67.0* less than or equal to 64.0*	Mud Weight (Density) API 13B-1 Section 1
Viscosity (seconds/quart) - during drilling - before final cleaning - just before placing concrete	 45 to 104 less than or equal to 104	Marsh Funnel and Cup API 13B-1 Section 2.2
pH	6.0 to 11.5	Glass Electrode pH Meter or pH Paper
Sand Content (percent) - before final cleaning -just before placing concrete	 less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, slurry may be used in salt water, and the allowable densities may be increased up to 2 pcf. Slurry temperature shall be at least 40°F when tested.		

Water Slurry

At the option of the Contractor, water may be used as slurry when casing is used for the entire length of the drilled hole. Water slurry shall be tested for conformance to the requirements shown in the following table:

WATER SLURRY		
PROPERTY	REQUIREMENT	TEST
Density (pcf) - before final cleaning - just before placing concrete	63.5*	Mud Weight (Density) API 13B-1 Section 1
Sand Content (percent) - before final cleaning -just before placing concrete	less than or equal to 0.5	Sand API 13B-1 Section 5
*When approved by the Engineer, salt water slurry may be used and the allowable densities may be increased up to 2 pcf.		

Construction

The Contractor shall submit a placing plan to the Engineer for approval prior to producing the test batch for cast-in-drilled-hole concrete piling and at least 10 working days prior to constructing piling. The plan shall include complete descriptions, details, and supporting calculations as listed below:

A. Requirements for all cast-in-drilled-hole concrete piling:

1. Concrete mix design, certified test data, and trial batch reports.
2. Drilling or coring methods and equipment.
3. Proposed method for casing installation and removal when necessary.
4. Plan view drawing of pile showing reinforcement and inspection pipes, if required.
5. Methods for placing, positioning, and supporting bar reinforcement.
6. Methods and equipment for accurately determining the depth of concrete and actual and theoretical volume placed, including effects on volume of concrete when any casings are withdrawn.
7. Methods and equipment for verifying that the bottom of the drilled hole is clean prior to placing concrete.
8. Methods and equipment for preventing upward movement of reinforcement, including the Contractor's means of detecting and measuring upward movement during concrete placement operations.

B. Additional requirements when concrete is placed under slurry:

1. Concrete batching, delivery, and placing systems, including time schedules and capacities therefor. Time schedules shall include the time required for each concrete placing operation at each pile.
2. Concrete placing rate calculations. When requested by the Engineer, calculations shall be based on the initial pump pressures or static head on the concrete and losses throughout the placing system, including anticipated head of slurry and concrete to be displaced.
3. Suppliers' test reports on the physical and chemical properties of the slurry and any proposed slurry chemical additives, including Material Safety Data Sheet.
4. Slurry testing equipment and procedures.
5. Methods of removal and disposal of excavation, slurry, and contaminated concrete, including removal rates.
6. Methods and equipment for slurry agitating, recirculating, and cleaning.

In addition to compressive strength requirements, the consistency of the concrete to be deposited under slurry shall be verified before use by producing a test batch. The test batch shall be produced and delivered to the project under conditions and in time periods similar to those expected during the placement of concrete in the piles. Concrete for the test batch shall be placed in an excavated hole or suitable container of adequate size to allow for testing as specified herein. Depositing of test batch concrete under slurry will not be required. In addition to meeting the specified nominal penetration, the test batch shall meet the following requirements:

A. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be 2 hours or less, the test batch shall demonstrate that the proposed concrete mix design achieves either a penetration of at least 2 inches or a slump of at least 5 inches after twice that time has elapsed.
B. For piles where the time required for each concrete placing operation, as submitted in the placing plan, will be more than 2 hours, the test batch shall demonstrate that the proposed concrete mix design achieves either a penetration of at least 2 inches or a slump of at least 5 inches after that time plus 2 hours has elapsed.

The time period shall begin at the start of placement. The concrete shall not be vibrated or agitated during the test period. Penetration tests shall be performed in conformance with the requirements in California Test 533. Slump tests shall be performed in conformance with the requirements in ASTM Designation: C 143/C143M. Upon completion of testing, the concrete shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The concrete deposited under slurry shall be carefully placed in a compact, monolithic mass and by a method that will prevent washing of the concrete. Concrete deposited under slurry need not be vibrated. Placing concrete shall be a continuous operation lasting not more than the time required for each concrete placing operation at each pile, as submitted in the placing plan, unless otherwise approved in writing by the Engineer. The concrete shall be placed with concrete pumps and delivery tube system of adequate number and size to complete the placing of concrete in the time specified. The delivery tube system shall consist of one of the following:

A. A tremie tube or tubes, each of which are at least 10 inches in diameter, fed by one or more concrete pumps.
B. One or more concrete pump tubes, each fed by a single concrete pump.

The delivery tube system shall consist of watertight tubes with sufficient rigidity to keep the ends always in the mass of concrete placed. If only one delivery tube is utilized to place the concrete, the tube shall be placed near the center of the drilled hole. Multiple tubes shall be uniformly spaced in the hole. Internal bracing for the steel reinforcing cage shall accommodate the delivery tube system. Tremies shall not be used for piles without space for a 10-inch tube.

Spillage of concrete into the slurry during concrete placing operations shall not be allowed. Delivery tubes shall be capped with a watertight cap, or plugged above the slurry level with a good quality, tight fitting, moving plug that will expel the slurry from the tube as the tube is charged with concrete. The cap or plug shall be designed to be released as the tube is charged. The pump discharge or tremie tube shall extend to the bottom of the hole before charging the tube with concrete. After charging the delivery tube system with concrete, the flow of concrete through a tube shall be induced by slightly raising the discharge end. During concrete placement, the tip of the delivery tube shall be maintained as follows to prevent reentry of the slurry into the tube. Until at least 10 feet of concrete has been placed, the tip of the delivery tube shall be within 6 inches of the bottom of the drilled hole, and then the embedment of the tip shall be maintained at least 10 feet below the top surface of the concrete. Rapid raising or lowering of the delivery tube shall not be permitted. If the seal is lost or the delivery tube becomes plugged and must be removed, the tube shall be withdrawn, the tube cleaned, the tip of the tube capped to prevent entrance of the slurry, and the operation restarted by pushing the capped tube 10 feet into the concrete and then reinitiating the flow of concrete.

When slurry is used, a fully operational standby concrete pump, adequate to complete the work in the time specified, shall be provided at the site during concrete placement. The slurry level shall be maintained within 12 inches of the top of the drilled hole.

A log of concrete placement for each drilled hole shall be maintained by the Contractor when concrete is deposited under slurry. The log shall show the pile location, tip elevation, dates of excavation and concrete placement, total quantity of concrete deposited, length and tip elevation of any casing, and details of any hole stabilization method and materials used. The log shall include a 8-1/2" x 11" sized graph of the concrete placed versus depth of hole filled. The graph shall be plotted continuously throughout placing of concrete. The depth of drilled hole filled shall be plotted vertically with the pile tip oriented at the bottom and the quantity of concrete shall be plotted horizontally. Readings shall be made at least at each 5 feet of pile depth, and the time of the reading shall be indicated. The graph shall be labeled with the pile location, tip elevation, cutoff elevation, and the dates of excavation and concrete placement. The log shall be delivered to the Engineer within one working day of completion of placing concrete in the pile.

After placing reinforcement and prior to placing concrete in the drilled hole, if drill cuttings settle out of the slurry, the bottom of the drilled hole shall be cleaned. The Contractor shall verify that the bottom of the drilled hole is clean.

If temporary casing is used, concrete placed under slurry shall be maintained at a level at least 5 feet above the bottom of the casing. The withdrawal of casings shall not cause contamination of the concrete with slurry.

Material resulting from using slurry shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Acceptance Testing and Mitigation

Vertical inspection pipes for acceptance testing shall be provided in all cast-in-drilled-hole concrete piles that are 24 inches in diameter or larger, except when the holes are dry or when the holes are dewatered without the use of temporary casing to control ground water.

Inspection pipes shall be Schedule 40 polyvinyl chloride pipes with a nominal inside diameter of 2 inches. Each inspection pipe shall be capped top and bottom and shall have watertight couplers to provide a clean, dry and unobstructed 2-inch-diameter clear opening from 3 feet above the pile cutoff down to the bottom of the reinforcing cage.

If the Contractor drills the hole below the specified tip elevation, the reinforcement and the inspection pipes shall be extended to 3 inches clear of the bottom of the drilled hole.

Inspection pipes shall be placed around the pile, inside the outermost spiral or hoop reinforcement, and 3 inches clear of the vertical reinforcement, at a uniform spacing not exceeding 2 feet 9 inches measured along the circle passing through the centers of inspection pipes. A minimum of 2 inspection pipes per pile shall be used. When the vertical reinforcement is not bundled and each bar is not more than one inch in diameter, inspection pipes may be placed 2 inches clear of the vertical reinforcement. The inspection pipes shall be placed to provide the maximum diameter circle that passes through the centers of the inspection pipes while maintaining the clear spacing required herein. The pipes shall be installed in straight alignment, parallel to the main reinforcement, and securely fastened in place to prevent misalignment during installation of the reinforcement and placing of concrete in the hole.

The Contractor shall log the location of the inspection pipe couplers with respect to the plane of pile cut off, and these logs shall be delivered to the Engineer upon completion of the placement of concrete in the drilled hole.

After placing concrete and before requesting acceptance tests, each inspection pipe shall be tested by the Contractor in the presence of the Engineer by passing a 1.9-inch-diameter rigid cylinder 2 feet long through the complete length of pipe. If the 1.9-inch-diameter rigid cylinder fails to pass any of the inspection pipes, the Contractor shall attempt to pass a 1-1/4-inch-diameter rigid cylinder 4.5 feet long through the complete length of those pipes in the presence of the Engineer. If an inspection pipe fails to pass the 1-1/4-inch-diameter cylinder, the Contractor shall immediately fill all inspection pipes in the pile with water.

The Contractor shall replace each inspection pipe that does not pass the 1-1/4-inch-diameter cylinder with a 2-inch-diameter hole cored through the concrete for the entire length of the pile. Cored holes shall be located as close as possible to the inspection pipes they are replacing and shall be no more than 6 inches inside the reinforcement. Coring shall not damage the pile reinforcement. Cored holes shall be made with a double wall core barrel system utilizing a split tube type inner barrel. Coring with a solid type inner barrel will not be allowed. Coring methods and equipment shall provide intact cores for the entire length of the pile concrete. The coring operation shall be logged by an Engineering Geologist or Civil Engineer licensed in the State of California and experienced in core logging. Coring logs shall include complete descriptions of inclusions and voids encountered during coring, and shall be delivered to the Engineer upon completion. Concrete cores shall be preserved, identified with the exact location the core was recovered from within the pile, and made available for inspection by the Engineer.

Acceptance tests of the concrete will be made by the Engineer, without cost to the Contractor. Acceptance tests will evaluate the homogeneity of the placed concrete. Tests will include gamma-gamma logging. Tests may also include crosshole sonic logging and other means of inspection selected by the Engineer. The Contractor shall not conduct operations within 25 feet of the gamma-gamma logging operations. The Contractor shall separate reinforcing steel as necessary to allow the Engineer access to the inspection pipes to perform gamma-gamma logging or other acceptance testing. After requesting acceptance tests and providing access to the piling, the Contractor shall allow 3 weeks for the Engineer to conduct these tests and make determination of acceptance if the 1.9-inch-diameter cylinder passed all inspection pipes, and 4 weeks if only the 1-1/4-inch-diameter cylinder passed all inspection pipes. Should the Engineer fail to complete these tests within the time allowance, and if in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in inspection, the delay will be considered a right of way delay as specified in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

All inspection pipes and cored holes in a pile shall be dewatered and filled with grout after notification by the Engineer that the pile is acceptable. Placement and removal of water in the inspection pipes shall be at the Contractor’s expense. Grout shall conform to the provisions in Section 50-1.09, "Bonding and Grouting," of the Standard Specifications. The inspection pipes and holes shall be filled using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

If acceptance testing performed by the Engineer determines that a pile does not meet the requirements of the specifications, then that pile will be rejected and all depositing of concrete under slurry or concrete placed using temporary casing for the purpose of controlling groundwater shall be suspended until written changes to the methods of pile construction are approved in writing by the Engineer.

The Contractor shall submit to the Engineer for approval a mitigation plan for repair, supplementation, or replacement for each rejected cast-in-drilled-hole concrete pile, and this plan shall conform to the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Prior to submitting this mitigation plan, the Engineer will hold a repair feasibility meeting with the Contractor to discuss the feasibility of repairing rejected piling. The Engineer will consider the size of the defect, the location of the defect, and the design information and corrosion protection considerations for the pile. This information will be made available to the Contractor, if appropriate, for the development of the mitigation plan. If the Engineer determines that it is not feasible to repair the rejected pile, the Contractor shall not include repair as a means of mitigation and shall proceed with the submittal of a mitigation plan for replacement or supplementation of the rejected pile.

If the Engineer determines that a rejected pile does not require mitigation due to structural, geotechnical, or corrosion concerns, the Contractor may elect to 1) repair the pile per the approved mitigation plan, or 2) not repair anomalies found during acceptance testing of that pile. For such unrepaired piles, the Contractor shall pay to the State, $300 per cubic yard for the portion of the pile affected by the anomalies. The volume, in cubic yards, of the portion of the pile affected by the anomalies, shall be calculated as the area of the cross section of the pile affected by each anomaly, in square yards, as determined by the Engineer, multiplied by the distance, in yards, from the top of each anomaly to the specified tip of the pile. If the volume calculated for one anomaly overlaps the volume calculated for additional anomalies within the pile, the calculated volume for the overlap shall only be counted once. In no case shall the amount of the payment to the State for any such pile be less than $300. The Department may deduct the amount from any moneys due, or that may become due the Contractor under the contract.

Pile mitigation plans shall include the following:

A. The designation and location of the pile addressed by the mitigation plan.
B. A review of the structural, geotechnical, and corrosion design requirements of the rejected pile.
C. A step by step description of the mitigation work to be performed, including drawings if necessary.
D. An assessment of how the proposed mitigation work will address the structural, geotechnical, and corrosion design requirements of the rejected pile.
E. Methods for preservation or restoration of existing earthen materials.
F. A list of affected facilities, if any, with methods and equipment for protection of these facilities during mitigation.
G. The State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Post Mile, and the Contractor's (and Subcontractor's if applicable) name on each sheet.
H. A list of materials, with quantity estimates, and personnel, with qualifications, to be used to perform the mitigation work.
I. The seal and signature of an engineer who is licensed as a Civil Engineer by the State of California.

For rejected piles to be repaired, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. An assessment of the nature and size of the anomalies in the rejected pile.
B. Provisions for access for additional pile testing if required by the Engineer.

For rejected piles to be replaced or supplemented, the Contractor shall submit a pile mitigation plan that contains the following additional information:

A. The proposed location and size of additional piling.
B. Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piling.

All provisions for cast-in-drilled-hole concrete piling shall apply to replacement piling.

The Contractor shall allow the Engineer 3 weeks to review the mitigation plan after a complete submittal has been received.

Should the Engineer fail to review the complete pile mitigation submittal within the time specified, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in reviewing the pile mitigation plan, an extension of time commensurate with the delay in completion of the work thus caused will be granted in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

When repairs are performed, the Contractor shall submit a mitigation report to the Engineer within 10 days of completion of the repair. This report shall state exactly what repair work was performed and quantify the success of the repairs relative to the submitted mitigation plan. The mitigation report shall be stamped and signed by an engineer that is licensed as a Civil Engineer by the State of California. The mitigation report shall show the State assigned contract number, bridge number, full name of the structure as shown on the contract plans, District-County-Route-Post Mile, and the Contractor (and subcontractor if applicable) name on each sheet. The Engineer will be the sole judge as to whether a mitigation proposal is acceptable, the mitigation efforts are successful, and to whether additional repairs, removal and replacement, or construction of a supplemental foundation is required.

10-1.31 CONCRETE STRUCTURES

Portland cement concrete for sitework structures shall conform to the provisions in Section 51, "Concrete Structures," of the Standard Specifications.

10-1.32 REINFORCEMENT

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and these special provisions.

The Department's mechanical splices prequalified list can be found at:

http://www.dot.ca.gov/hq/esc/approved_products_list/

The provisions in "Welding Quality Control" of these special provisions shall not apply to resistance butt welding.

10-1.33 STEEL STRUCTURES

Construction of steel structures shall conform to the provisions in Section 55, "Steel Structures," of the Standard Specifications and these special provisions.

Attention is directed to "Welding" in Section 8, "Materials," of these special provisions.

High-strength fastener assemblies and other bolts attached to structural steel with nuts and washers shall be zinc coated. When direct tension indicators are used in these assemblies, the direct tension indicator and all components of the fastener assembly shall be zinc coated by the mechanical deposition process.

ROTATIONAL CAPACITY TESTING PRIOR TO SHIPMENT TO JOB SITE

Rotational capacity tests shall be performed on all lots of high-strength fastener assemblies prior to shipment of these lots to the project site. Zinc-coated assemblies shall be tested after all fabrication, coating, and lubrication of components has been completed. One hardened washer shall be used under each nut for the tests.

The requirements of this section do not apply to high-strength cap screws or high-strength bolts used for slip base plates.

Each combination of bolt production lot, nut lot, and washer lot shall be tested as an assembly.

A rotational capacity lot number shall be assigned to each combination of lots tested. Each shipping unit of fastener assemblies shall be plainly marked with the rotational capacity lot number.

Two fastener assemblies from each rotational capacity lot shall be tested.

The following equipment, procedure, and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of long bolts. Fasteners are considered to be long bolts when full nut thread engagement can be achieved when installed in a bolt tension measuring device:

A. Long Bolt Test Equipment:

1. Calibrated bolt tension measuring device with adequate tension capacity for the bolts being tested.
2. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Long Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F 436.
4. Steel beam or member, such as a girder flange or cross frame, to which the bolt tension measuring device will be attached. The device shall be accessible from the ground.

B Long Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Insert the bolt into the bolt tension measuring device and install the required number of washers, and additional spacers as needed, directly beneath the nut to produce the thread stickout measured in Step 2 of this procedure.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug tension shall not be less than the Table A value but may exceed the Table A value by a maximum of 2 kips.

Table A

High-Strength Fastener Assembly Tension Values to Approximate Snug-Tight Condition	
Bolt Diameter (inches)	Snug Tension (kips)
1/2	1
5/8	2
3/4	3
7/8	4
1	5
1-1/8	6
1-1/4	7
1-3/8	9
1-1/2	10

5. Match-mark the assembly by placing a heavy reference start line on the face plate of the bolt tension measuring device which aligns with (1) a mark placed on one corner of the nut and (2) a radial line placed across the flat on the end of the bolt or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make an additional mark on the face plate, either 2/3 of a turn, one turn, or 1-1/3 turn clockwise from the heavy reference start line, depending on the bolt length being tested as shown in Table B.

Table B

Required Nut Rotation for Rotational Capacity Tests[(a) (b)]	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3
Greater than 4 bolt diameters but no more than 8 bolt diameters	1
Greater than 8 bolt diameters, but no more than 12 bolt diameters[(c)]	1-1/3

(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance shall be plus or minus 45 degrees.
(b) Applicable only to connections in which all material within grip of the bolt is steel.
(c) When bolt length exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.

6. Turn the nut to achieve the applicable minimum bolt tension value listed in Table C. After reaching this tension, record the moving torque, in foot-pounds, required to turn the nut, and also record the corresponding bolt tension value in pounds. Torque shall be measured with the nut in motion. Calculate the value, T, where T = [(the measured tension in pounds) x (the bolt diameter in inches) / 48].

Table C

Minimum Tension Values for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Minimum Tension (kips)
1/2	12
5/8	19
3/4	28
7/8	39
1	51
1-1/8	56
1-1/4	71
1-3/8	85
1-1/2	103

7. Turn the nut further to increase bolt tension until the rotation listed in Table B is reached. The rotation is measured from the heavy reference line made on the face plate after the bolt was snug-tight. Record this bolt tension.
8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Long Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: (1) the measured moving torque (Step 6) shall be less than or equal to the calculated value, T (Step 6), (2) the bolt tension measured in Step 7 shall be greater than or equal to the applicable turn test tension value listed in Table D, (3) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, (4) the bolt does not shear from torsion or fail during the test, and (5) the assembly does not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head is expected and will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

Table D

Turn Test Tension Values	
Bolt Diameter (inches)	Turn Test Tension (kips)
1/2	14
5/8	22
3/4	32
7/8	45
1	59
1-1/8	64
1-1/4	82
1-3/8	98
1-1/2	118

The following equipment, procedure, and acceptance criteria shall be used to perform rotational capacity tests on and determine acceptance of short bolts. Fasteners are considered to be short bolts when full nut thread engagement cannot be achieved when installed in a bolt tension measuring device:

A. Short Bolt Test Equipment:

1. Calibrated dial or digital torque wrench. Other suitable tools will be required for performing Steps 7 and 8 of the Short Bolt Test Procedure. A torque multiplier may be required for large diameter bolts.
2. Spud wrench or equivalent.

3. Spacer washers or bushings. When spacer washers or bushings are required, they shall have the same inside diameter and equal or larger outside diameter as the appropriate hardened washers conforming to the requirements in ASTM Designation: F 436.
4. Steel plate or girder with a hole to install bolt. The hole size shall be 1/16 inch greater than the nominal diameter of the bolt to be tested. The grip length, including any plates, washers, and additional spacers as needed, shall provide the proper number of threads within the grip, as required in Step 2 of the Short Bolt Test Procedure.

B. Short Bolt Test Procedure:

1. Measure the bolt length. The bolt length is defined as the distance from the end of the threaded portion of the shank to the underside of the bolt head.
2. Install the nut on the bolt so that 3 to 5 full threads of the bolt are located between the bearing face of the nut and the underside of the bolt head. Measure and record the thread stickout of the bolt. Thread stickout is determined by measuring the distance from the outer face of the nut to the end of the threaded portion of the shank.
3. Install the bolt into a hole on the plate or girder and install the required number of washers and additional spacers as needed between the bearing face of the nut and the underside of the bolt head to produce the thread stickout measured in Step 2 of this procedure.
4. Tighten the nut using a hand wrench to a snug-tight condition. The snug condition shall be the full manual effort applied to the end of a 12-inch long wrench. This applied torque shall not exceed 20 percent of the maximum allowable torque in Table E.

Table E

Maximum Allowable Torque for High-Strength Fastener Assemblies	
Bolt Diameter (inches)	Torque (ft-lb)
1/2	145
5/8	285
3/4	500
7/8	820
1	1220
1-1/8	1500
1-1/4	2130
1-3/8	2800
1-1/2	3700

5. Match-mark the assembly by placing a heavy reference start line on the steel plate or girder which aligns with (1) a mark placed on one corner of the nut and (2) a radial line placed across the flat on the end of the bolt or on the exposed portions of the threads of tension control bolts. Place an additional mark on the outside of the socket that overlays the mark on the nut corner such that this mark will be visible while turning the nut. Make 2 additional small marks on the steel plate or girder, one 1/3 of a turn and one 2/3 of a turn clockwise from the heavy reference start line on the steel plate or girder.
6. Using the torque wrench, tighten the nut to the rotation value listed in Table F. The rotation is measured from the heavy reference line described in Step 5 made after the bolt was snug-tight. A second wrench shall be used to prevent rotation of the bolt head during tightening. Measure and record the moving torque after this rotation has been reached. The torque shall be measured with the nut in motion.

Table F

Nut Rotation Required for Turn-of-Nut Installation[a] [,b]	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	1/3

(a) Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance shall be plus or minus 30 degrees.
(b) Applicable only to connections in which all material within grip of the bolt is steel.

7. Tighten the nut further to the 2/3-turn mark as indicated in Table G. The rotation is measured from the heavy reference start line made on the plate or girder when the bolt was snug-tight. Verify that the radial line on the bolt end or on the exposed portions of the threads of tension control bolts is still in alignment with the start line.

Table G

Required Nut Rotation for Rotational Capacity Test	
Bolt Length (measured in Step 1)	Required Rotation (turn)
4 bolt diameters or less	2/3

8. Loosen and remove the nut and examine the threads on both the nut and bolt.

C. Short Bolt Acceptance Criteria:

1. An assembly shall pass the following requirements to be acceptable: (1) the measured moving torque from Step 6 shall be less than or equal to the maximum allowable torque from Table E, (2) the nut shall be able to be removed from the bolt without signs of thread stripping or galling after the required rotation in Step 7 has been achieved, (3) the bolt does not shear from torsion or fail during the test, and (4) the assembly shall not seize before the final rotation in Step 7 is reached. Elongation of the bolt in the threaded region between the bearing face of the nut and the underside of the bolt head will not be considered a failure. Both fastener assemblies tested from one rotational capacity lot shall pass for the rotational capacity lot to be acceptable.

INSTALLATION TENSION TESTING AND ROTATIONAL CAPACITY TESTING AFTER ARRIVAL ON THE JOB SITE

Installation tension tests and rotational capacity tests on high-strength fastener assemblies shall be performed by the Contractor prior to acceptance or installation and after arrival of the fastener assemblies on the project site. Installation tension tests and rotational capacity tests shall be performed at the job site, in the presence of the Engineer, on each rotational capacity lot of fastener assemblies.

The requirements of this section do not apply to high-strength cap screws or high-strength bolts used for slip base plates.

Installation tension tests shall be performed on 3 representative fastener assemblies in conformance with the provisions in Section 8, "Installation," of the RCSC Specification. For short bolts, Section 8.2, "Pretensioned Joints," of the RCSC Specification shall be replaced by the "Pre-Installation Testing Procedures," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated.

The rotational capacity tests shall be performed in conformance with the requirements for rotational capacity tests in "Rotational Capacity Testing Prior to Shipment to Job Site" of these special provisions.

At the Contractor's expense, additional installation tension tests, tests required to determine job inspecting torque, and rotational capacity tests shall be performed by the Contractor on each rotational capacity lot, in the presence of the Engineer, if:

1. Any fastener is not used within 3 months after arrival on the job site,
2. Fasteners are improperly handled, stored, or subjected to inclement weather prior to final tightening,
3. Significant changes are noted in original surface condition of threads, washers, or nut lubricant, or
4. The Contractor's required inspection is not performed within 48 hours after all fasteners in a joint have been tensioned.

Failure of a job-site installation tension test or a rotational capacity test will be cause for rejection of unused fasteners that are part of the rotational capacity lot.

When direct tension indicators are used, installation verification tests shall be performed in conformance with Appendix Section X1.4 of ASTM Designation: F 959, except that bolts shall be initially tensioned to a value 5 percent greater than the minimum required bolt tension.

When zinc-coated tension control bolts are used, the sheared end of each fastener shall be completely sealed with non-silicone type sealing compound conforming to the provisions in Federal Specification TT-S-230, Type II. The sealant shall be gray in color and shall have a minimum thickness of 50 mils. The sealant shall be applied to a clean sheared surface on the same day that the splined end is sheared off.

WELDING

Table 2.2 of AWS D1.5 is superseded by the following table:

Base Metal Thickness of the Thicker Part Joined, inches	Minimum Effective Partial Joint Penetration Groove Weld Size*, inches
Over 1/4 to 1/2 inclusive	3/16
Over 1/2 to 3/4 inclusive	1/4
Over 3/4 to 1-1/2 inclusive	5/16
Over 1-1/2 to 2-1/4 inclusive	3/8
Over 2-1/4 to 6 inclusive	1/2
Over 6	5/8

* Except the weld size need not exceed the thickness of the thinner part

Dimensional details and workmanship for welded joints in tubular and pipe connections shall conform to the provisions in Part A, "Common Requirements of Nontubular and Tubular Connections," and Part D, "Specific Requirements for Tubular Connections," in Section 2 of AWS D1.1.

The requirement of conformance with AWS D1.5 shall not apply to work conforming to Section 56-1, "Overhead Sign Structures," or Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications.

MEASUREMENT AND PAYMENT

Full compensation for conforming to the requirements of "Steel Structures" shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

10-1.34 FURNISH SIGN

Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions.

Traffic Sign Specifications for California sign codes are available for review at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:

http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm

Information on cross-referencing California sign codes with the Federal MUTCD sign codes is available at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Temporary or permanent signs shall be free from blemishes that may affect the serviceability and detract from the general sign color and appearance when viewing during daytime and nighttime from a distance of 25 feet. The face of each finished sign shall be uniform, flat, smooth, and free of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels shall be free of router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over spray and aluminum marks.

QUALITY CONTROL FOR SIGNS

The requirements of "Quality Control for Signs" in this section shall not apply to construction area signs.

No later than 14 days before sign fabrication, the Contractor shall submit a written copy of the quality control plan for signs to the Engineer for review. The Engineer will have 10 days to review the quality control plan. Sign fabrication shall not begin until the Engineer approves the Contractor's quality control plan in writing. The Contractor shall submit to the Engineer at least 3 copies of the approved quality control plan. The quality control plan shall include, but not be limited to the following requirements:

A. Identification of the party responsible for quality control of signs,
B. Basis of acceptance for incoming raw materials at the fabrication facility,
C. Type, method and frequency of quality control testing at the fabrication facility,
D. List (by manufacturer and product name) of process colors, protective overlay film, retroreflective sheeting and black non-reflective film,
E. Recommended cleaning procedure for each product, and
F. Method of packaging, transport and storage for signs.

No legend shall be installed at the project site. Legend shall include letters, numerals, tildes, bars, arrows, route shields, symbols, logos, borders, artwork, and miscellaneous characters. The style, font, size, and spacing of the legend shall conform to the Standard Alphabets published in the FHWA Standard Highway Signs Book. The legend shall be oriented in the same direction in accordance with the manufacturer's orientation marks found on the retroreflective sheeting.

On multiple panel signs, legend shall be placed across joints without affecting the size, shape, spacing, and appearance of the legend. Background and legend shall be wrapped around interior edges of formed panel signs as shown on plans to prevent delamination.

The following notation shall be placed on the lower right side of the back of each sign where the notation will not be blocked by the sign post or frame:

A. PROPERTY OF STATE OF CALIFORNIA,
B. Name of the sign manufacturer,
C. Month and year of fabrication,
D. Type of retroreflective sheeting, and
E. Manufacturer's identification and lot number of retroreflective sheeting.

The above notation shall be applied directly to the aluminum sign panels in 1/4-inch upper case letters and numerals by die-stamp and applied by similar method to the fiberglass reinforced plastic signs. Painting, screening, or engraving the notation will not be allowed. The notation shall be applied without damaging the finish of the sign.

Signs with a protective overlay film shall be marked with a dot of 3/8 inch in diameter. The dot placed on white border shall be black, while the dot placed on black border shall be white. The dot shall be placed on the lower border of the sign before application of the protective overlay film and shall not be placed over the legend and bolt holes. The application method and exact location of the dot shall be determined by the manufacturer of the signs.

For sign panels that have a minor dimension of 48 inches or less, no splice will be allowed in the retroreflective sheet except for the splice produced during the manufacturing of the retroreflective sheeting. For sign panels that have a minor dimension greater than 48 inches, only one horizontal splice will be allowed in the retroreflective sheeting.

Unless specified by the manufacturer of the retroreflective sheeting, splices in retroreflective sheeting shall overlap by a minimum of one inch. Splices shall not be placed within 2 inches from edges of the panels. Except at the horizontal borders, the splices shall overlap in the direction from top to bottom of the sign to prevent moisture penetration. The retroreflective sheeting at the overlap shall not exhibit a color difference under the incident and reflected light.

Signs exhibiting a significant color difference between daytime and nighttime shall be replaced immediately.

Repairing sign panels will not be allowed except when approved by the Engineer.

The Department will inspect signs at the Contractor's facility and delivery location, and in accordance with Section 6, "Control of Materials," of the Standard Specifications. The Engineer will inspect signs for damage and defects before and after installation.

Regardless of kind, size, type, or whether delivered by the Contractor or by a common carrier, signs shall be protected by thorough wrapping, tarping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Signs shall be dry during transit and shipped on palettes, in crates, or tier racks. Padding and protective materials shall be placed between signs as appropriate. Finished sign panels shall be transported and stored by method that protects the face of signs from damage. The Contractor shall replace wet, damaged, and defective signs.

Signs shall be stored in dry environment at all times. Signs shall not rest directly on the ground or become wet during storage. Signs, whether stored indoor or outdoor, shall be free standing. In areas of high heat and humidity signs shall be stored in enclosed climate-controlled trailers or containers. Signs shall be stored indoor if duration of the storage will exceed 30 days.

Screen processed signs shall be protected, transported and stored as recommended by the manufacturer of the retroreflective sheeting.

When requested, the Contractor shall provide the Engineer test samples of signs and materials used at various stages of production. Sign samples shall be 12" x 12" in size with applied background, letter or numeral, and border strip.

The Contractor shall assume the costs and responsibilities resulting from the use of patented materials, equipment, devices, and processes for the Contractor's work.

Sheet Aluminum

Alloy and temper designations for sheet aluminum shall be in accordance with ASTM Designation: B 209.

The Contractor shall furnish the Engineer a Certificate of Compliance in conformance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the sheet aluminum.

Sheet aluminum shall be pretreated in accordance to ASTM Designation: B 449. Surface of the sheet aluminum shall be cleaned, deoxidized, and coated with a light and tightly adherent chromate conversion coating free of powdery residue. The conversion coating shall be Class 2 with a weight between 10 milligrams per square foot and 35 milligrams per square foot, and an average weight of 25 milligrams per square foot. Following the cleaning and coating process, the sheet aluminum shall be protected from exposure to grease, oils, dust, and contaminants.

Sheet aluminum shall be free of buckles, warps, dents, cockles, burrs, and defects resulting from fabrication.

Base plate for standard route marker shall be die cut.

Retroreflective Sheeting

The Contractor shall furnish retroreflective sheeting for sign background and legend in conformance with ASTM Designation: D 4956 and "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Retroreflective sheeting shall be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, and damage.

Class 1, 3, or 4 adhesive backing shall be used for Type II, III, IV, VII, VIII, and IX retroreflective sheeting. Class 2 adhesive backing may also be used for Type II retroreflective sheeting. The adhesive backing shall be pressure sensitive and fungus resistant.

When the color of the retroreflective sheeting determined from instrumental testing is in dispute, the Engineer's visual test will govern.

Process Color And Film

The Contractor shall furnish and apply screened process color, non-reflective opaque black film, and protective overlay film of the type, kind, and product that are approved by the manufacturer of the retroreflective sheeting.

The Contractor shall furnish the Engineer a Certificate of Compliance in accordance to Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for the screened process color, non-reflective opaque black film, and protective overlay film.

The surface of the screened process color shall be flat and smooth. When the screened process colors determined from the instrumental testing in accordance to ASTM Designation: D 4956 are in dispute, the Engineer's visual test will govern.

The Contractor shall provide patterns, layouts, and set-ups necessary for the screened process.

The Contractor may use green, red, blue, and brown reverse-screened process colors for background and non-reflective opaque black film or black screened process color for legend. The coefficient of retroreflection for reverse-screened process colors on white retroreflective sheeting shall not be less than 70 percent of the coefficient of retroreflection specified in ASTM Designation: D 4956.

The screened process colors and non-reflective opaque black film shall have the same outdoor weatherability as that of the retroreflective sheeting.

After curing, screened process colors shall withstand removal when tested by applying 3M Company Scotch Brand Cellophane Tape No. 600 or equivalent tape over the color and removing with one quick motion at 90° angle.

Single Sheet Aluminum Sign

Single sheet aluminum signs shall be fabricated and furnished with or without frame. The Contractor shall furnish the sheet aluminum in accordance to "Sheet Aluminum" of these special provisions. Single sheet aluminum signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38.

Single Sheet aluminum signs shall not have a vertical splice in the sheet aluminum. For signs with depth greater than 48 inches, one horizontal splice will be allowed in the sheet aluminum.

Framing for single sheet aluminum signs shall consist of aluminum channel or rectangular aluminum tubing. The framing shall have a length tolerance of ±1/8 inch. The face sheet shall be affixed to the frame with rivets of 3/16-inch diameter. Rivets shall be placed within the web of channels and shall not be placed less than 1/2 inch from edges of the sign panels. Rivets shall be made of aluminum alloy 5052 and shall be anodized or treated with conversion coating to prevent corrosion. The exposed portion of rivets on the face of signs shall be the same color as the background or legend where the rivets are placed.

Finished signs shall be flat within a tolerance of ±1/32 inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within ±1/8 inch of the detailed dimensions.

Aluminum channels or rectangular aluminum tubings shall be welded together with the inert gas shielded-arc welding process using E4043 aluminum electrode filler wires as shown on the plans. Width of the filler shall be equal to wall thickness of smallest welded channel or tubing.

Support Post

Support post shall be commercial quality, standard weight, galvanized steel pipe. Pipe diameter shall be 1¾ inch.

Fastening Hardware

Fastening hardware shall be galvanized or cadmium plated.

Concrete

Concrete for support posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 470 pounds of cement per cubic yard.

INSTALLATION

Support posts shall be placed in holes excavated to the depth and cross-section shown on the plans. Posts shall be set vertical and shall be firmly embedded in concrete backfill. The top of the concrete backfill around the post shall be crowned to drain water.

Support posts shall be fitted with a rainproof top.

Sign shall be fastened rigidly and securely to the support post.

The Engineer will provide the Contractor with the necessary information for the disabled authorization sign.

MEASUREMENT AND PAYMENT

Furnishing signs (except for construction area signs) for accessible parking and authorization signs will be measured by the square foot and the quantity to be paid for will be the total area, in square feet, of the sign panel types installed in place.

The contract price paid per square foot for furnish sign of the types specified in the Engineer's estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fabricating and furnishing the signs, including fastening hardware, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.35 ACCESSIBLE PARKING AND AUTHORIZATION SIGNS

This work shall consist of furnishing and installing accessible parking and authorization signs in accordance with the provisions in Section 56, "Signs," of the Standard Specifications and the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and sign fastening details shall be submitted for approval.

MATERIALS

Accessible Parking Stall Identification Sign

Accessible parking stall identification sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol, lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Van Accessible Sign

Van accessible sign shall be a metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Unauthorized Vehicles Parking Sign

Unauthorized vehicles parking sign shall be a metal sign with baked enamel finish. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886. Lettering shall be not less than one-inch in height and shall read as shown on the plans.

10-1.36 SITE IDENTIFICATION SIGNS

This work shall consist of constructing and installing site identification signs in accordance with the details shown on the plans and these special provisions.

Simulated stone veneer shall conform to the site identification sign plans.

Concrete for the site identification signs shall be minor concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications, except for aggregate size. The color of Portland cement concrete for the site identification signs shall be Federal Color #20450, as shown on the plans.

Colored concrete for the site identification signs shall be cured by the water method. Seals and curing compounds shall not be used.

Reinforcement for the site identification signs shall conform to the provisions in Section 52, "Reinforcing Steel," of the Standard Specifications.

Prior to constructing the sign identification signs, the Contractor shall construct a test panel at least 12" x 12" for approval by the Engineer. The test panel shall be constructed of the same materials as are proposed for the permanent work and shall be finished as specified for the permanent work. If ordered by the Engineer, additional test panels shall be constructed and finished until the texture and color are obtained, as determined by the Engineer.

The test panel approved by the Engineer shall be used as the standard of comparison in determining acceptability of the sign identification surfaces.

The contract unit price paid for site identification signs shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing site identification signs, complete in place, including simulated stone veneer and paint, as shown on the plans, as specified in the Standard Specification and these special provisions, and as directed by the Engineer.

10-1.37 ALTERNATIVE PIPE

Alternative pipe culverts shall conform to the provisions in Section 62, "Alternative Culverts," of the Standard Specifications and these special provisions.

SPIRAL RIB PIPE

Spiral rib pipe shall conform to the provisions in "Corrugated Metal Pipe" of these special provisions, except for profile and fabrication requirements.

Spiral rib pipe shall, at the option of the Contractor, consist of either (1) three rectangular ribs spaced midway between seams with ribs 3/4 inch wide by 3/4 inch high at a maximum rib pitch of 7-1/2 inches, (2) two rectangular ribs and one half-circle rib equally spaced between seams with ribs 3/4 inch wide by one inch high at a maximum rib pitch of 11-1/2 inches. The half-circle rib diameter shall be spaced midway between the rectangular ribs or (3) two rectangular ribs equally spaced between seams with ribs 3/4 inch wide by one inch high at a maximum rib pitch of 8 inches. Rib pitch measured at right angles to the direction of the ribs may vary ±1/2 inch.

Corrugated steel spiral rib pipe shall be fabricated by a continuous helical lock seam fabricated in conformance with the provisions in Section 66-3.03C(1), "Fabrication by Continuous Lock Seam," of the Standard Specifications.

Corrugated aluminum spiral rib pipe shall be fabricated by a continuous helical lock seam fabricated in conformance with the provisions in Section 66-2.03B, "Fabrication by Continuous Helical Lock Seam," of the Standard Specifications.

Coupling bands for spiral rib pipe shall conform to the provisions in Section 66-1.07, "Coupling Bands," of the Standard Specifications. A coupling band shown on the plans or approved by the Engineer in conformance with the provisions in Section 61-1.02, "Performance Requirements for Culvert and Drainage Pipe Joints," of the Standard Specifications, for use on a pipe corrugation of 2-2/3" x 1/2 " for corrugated metal pipe may be used on spiral rib pipe having 2-2/3" x 1/2" rerolled annular ends. The width of band (W) for hat bands for pipe sizes larger than 48 inches in diameter shall be 3-3/4 inches.

10-1.38 PLASTIC PIPE

Plastic pipe and slotted PVC riser shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications.

10-1.39 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to the provisions in Section 65, "Reinforced Concrete Pipe," of the Standard Specifications and these special provisions.

Where embankment will not be placed over the top of the pipe, a relative compaction of not less than 85 percent shall be required below the pipe spring line for pipe installed using Method 1 backfill in trench, as shown on Standard Plan A62D. Where the pipe is to be placed under the traveled way, a relative compaction of not less than 90 percent shall be required unless the minimum distance between the top of the pipe and the pavement surface is the greater of 4 feet or one half of the outside diameter of the pipe.

Except as otherwise designated by classification on the plans or in the specifications, joints for culvert and drainage pipes shall conform to the plans or specifications for standard joints.

When reinforced concrete pipe is installed in conformance with the details shown on Standard Plan A62DA, the fifth paragraph of Section 19-3.04, "Water Control and Foundation Treatment," of the Standard Specifications shall not apply.

When solid rock or other unyielding material is encountered at the planned elevation of the bottom of the bedding, the material below the bottom of the bedding shall be removed to a depth of 1/50 of the height of the embankment over the top of the culvert, but not less than 6 inches nor more than 12 inches. The resulting trench below the bottom of the bedding shall be backfilled with structure backfill material in conformance with the provisions in Section 19-3.06, "Structure Backfill," of the Standard Specifications.

The excavation and backfill below the planned elevation of the bottom of the bedding will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

The Outer Bedding shown on Standard Plan A62DA shall not be compacted prior to placement of the pipe.

10-1.40 MISCELLANEOUS FACILITIES

Pipe inlets, risers and drainage manholes shall conform to the provisions in Section 70, "Miscellaneous Facilities," of the Standard Specifications and these special provisions.

Drainage manhole will be measured and paid for by the unit of the actual units installed in place.

10-1.41 MISCELLANEOUS CONCRETE CONSTRUCTION

Concrete curb, curb and gutter, sidewalk, swale, and driveways shall conform to the provisions in Section 73, "Concrete Curbs and Sidewalks," of the Standard Specifications and these special provisions.

The sidewalk shall be colored in conformance with the provisions in Section 72-6.03, "Materials," of the Standard Specifications.

The color of the sidewalk shall Quarry Red conforming to L.M. Scofield Color No. C-32, or equal-.

Colored concrete sidewalk shall be cured by the water method. Seals and curing compounds shall not be used.

The surface areas of colored sidewalk shall be abrasive blasted with fine abrasive to remove the sheen without exposing coarse aggregate.

Prior to constructing the colored sidewalk, the Contractor shall construct a test panel at least 4' x 6' at the site for approval by the Engineer. The test panel shall be constructed of the same materials as are proposed for the permanent work and shall be finished as specified for the permanent work. If ordered by the Engineer, additional test panels shall be constructed and finished until the texture and color are obtained, as determined by the Engineer.

The test panel approved by the Engineer shall be used as the standard of comparison in determining acceptability of concrete sidewalk surfaces.

Curb ramp detectable warning surface shall consist of raised truncated domes constructed or installed on curb ramps in conformance with the details shown on the plans and these special provisions. At the option of the Contractor, the detectable warning surface shall be prefabricated, cast-in-place, or stamped into the surface of the curb ramp. The color of the detectable warning surface shall be yellow conforming to Federal Standard 595B, Color No. 33538.

Prefabricated detectable warning surface shall be in conformance with the requirements established by the Department of General Services, Division of State Architect and be attached in conformance with the manufacturer's recommendations.

Cast-in-place and stamped detectable warning surfaces shall be painted in conformance with the provisions in Section 59-6, "Painting Concrete," of the Standard Specifications.

The finished surfaces of the detectable warning surface shall be free from blemishes.

Prior to constructing the cast-in-place or stamping the detectable warning surface, the Contractor shall demonstrate the ability to produce a detectable warning surface conforming to the details shown on the plans and these special provisions by constructing a 24" x 24" test panel.

The manufacturer shall provide a written 5-year warranty for prefabricated detectable warning surfaces, guaranteeing replacement when there is defect in the dome shape, color fastness, sound-on-cane acoustic quality, resilience, or attachment. The warranty period shall begin upon acceptance of the contract.

Curb ramps will be measured and paid for by the cubic yard as minor concrete (sidewalk).

Full compensation for constructing or furnishing and installing curb ramp detectable warning surfaces shall be considered as included in the contract price paid per cubic yard for minor concrete (sidewalk) and no separate payment will be made therefor.

Full compensation for furnishing concrete coloring material and abrasive blasting of exposed colored sidewalk surfacing shall be considered as included in the contract price paid per cubic yard for minor concrete (sidewalk) and no additional compensation will be allowed therefor.

Full compensation for furnishing additional exposed colored sidewalk surfacing test panels shall be considered as included in the contract price paid per cubic yard for minor concrete (sidewalk) and no additional compensation will be allowed therefor.

10-1.42 MISCELLANEOUS IRON AND STEEL

Miscellaneous iron and steel shall conform to the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications and these special provisions.

Full compensation for miscellaneous iron and steel used in manhole frame and cover shall be considered as included in the contract unit prices paid for the various types of manhole involved and no separate payment will be made therefor.

10-1.43 CHAIN LINK FENCE

Chain link fence shall be Type CL-6 and shall conform to the provisions in Section 80, "Fences," of the Standard Specifications.

10-1.44 ORNAMENTAL STEEL FENCE, SWING GATE AND ROLLING GATE

This work shall consist of furnishing and installing ornamental steel fence, swing gate, and rolling gate, in accordance with the details shown on the plans and these special provisions.

Steel fence, swing gate, and rolling gate shall include vertical pickets, horizontal rails, posts, steel tube gate frame with cross bracing and track and guide assemblies, and other accessories

Attention is directed to "Welding" and "Digital Entry Electronic Gate Control" of these special provisions.

SUBMITTALS

Product Data

Within 30 days after approval of contract, the Contractor shall submit manufacturer’s technical product data, installation instructions, and recommendations to the Engineer for approval. If revisions are required, as determined by the Engineer, the Contractor shall revise and resubmit within 7 days of receipt of the Engineer's comments. The Engineer will have 7 days to review the revisions. Upon the Engineer's approval of the product data, 3 additional copies of the product data and working drawings incorporating the required changes shall be submitted to the Engineer.

Product data shall include the manufacturer’s name and complete material description of all components of the fence, swing gate and rolling gate systems.

Samples

Material samples shall include 12 inches sample of fence pickets showing fabrication workmanship and finish coating.

Working Drawings

The Contractor shall submit a complete working drawing submittal for assembly and installation to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. Working drawings shall be 11 inches x 17 inches in size. For initial review, 4 sets of drawings shall be submitted. After review, between 5 and 8 sets, as requested by the Engineer, shall be submitted for final approval and use during construction.

Working drawings shall show the layout and details of the steel fence, swing gate and rolling gate.

Working drawings shall show the shape, size, thickness, steel grades, and method of attachment for each component used in the work; layout and spacing of fasteners or welding; footings; and details of connection.

Working drawings for ornamental steel fencing system shall show the State assigned designations for the contract number, full name of the project as shown on the contract plans, and District-County-Route-on each drawing and supporting calculation sheet. The Contractor's name, address, and telephone and fax numbers shall be shown on the working drawings. Each sheet shall be numbered in the lower right hand corner.

The Contractor shall allow the Engineer 15 working days to review the working drawings and supplement after a complete submittal has been received.

QUALITY ASSURANCE

Certificates of Compliance

Certificates of Compliance shall be furnished for the steel fence, swing gate, and rolling gate in accordance with the requirements provided in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

MATERIALS

Base Metal

Base metal shall have the minimum properties as follows:

Steel plates and shapes shall conform to ASTM Designation: A36.
Steel tubing shall conform to ASTM Designation: A500.
Steel pipe shall conform to ASTM Designation: A53.
Pickets shall be formed from commercial quality hot rolled sheets.

Tubing for pickets, rails, and posts shall be manufactured from coil steel having a yield strength of 45,000 psi and a tensile strength of 58,000 psi. Steel shall be hot-dipped galvanized after fabrication in accordance with "Metal Finishes" under this section.

Concrete

Concrete for fence posts and gate post foundation shall be minor concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications.

Reinforcing Steel

Reinforcing steel used in concrete fence footing shall conform to the provisions in Section 52, "Reinforcing Steel," of the Standard Specifications, except for payment.

Pickets Fence and gate pickets shall be square and of the size and length shown on the plans and a thickness of 16 gauge, minimum. Top of pickets shall be provided with a tight-fitting flat steel end caps.**Rails**

Fence and gate rails shall be square and of the size and dimensions shown on the plans. Fence rails shall be machine-punched to provide proper hole sizes to receive pickets and rivet fasteners .

Posts

Posts shall be of the size and dimensions shown on the plans. Top of posts shall be provided with a tight-fitting flat steel end caps. Steel post thicknesses shall conform to the following:

Corner and Line Posts: 14 gauge, minimum.
Gate Posts (Gate leaf less than 5' wide): 12 gauge, minimum
Gate Posts (Gate leaf 5' wide or greater): 12 gauge, minimum

Gate Frames

Gate frames shall be supplied with the same cross-sectional area as the fence rails. Gate frame connections shall be welded.

Fasteners

Fasteners for attaching fence pickets to the rails shall be industrial drive rivets of sufficient length to attach fence pickets in a secure manner. Rivets shall have a minimum tensile strength of 1,100 pounds and a minimum shear strength of 1,500 pounds. Pickets at gate leafs shall be connected to the rail and gate frames by welding.

Welding Connections

Welding connections for the fabrication of fence and gate components shall be shop-welded and shall conform to "Welding" of these special provisions. Welded connections shall be galvanized after fabrication.

Swing Gate Hardware

Swing gate hardware shall be stainless steel, heavy duty type commercial quality hardware of the size recommended by the gate manufacturer to support the gate without deformation of the gate leaf.

Rolling Gate

Rolling gate shall be V-wheel rolling gate with the manufacturer's standard assembly and track for rolling gates.

Wheel assembly shall consist of wheel box and sides with malleable iron. V-groove and axle as recommended by the gate manufacturer. Wheel axle shall be fitted for lubrication.

Track shall be inverted angle iron V track as recommended by the gate manufacturer.

Rolling gate shall be fitted with provisions for digital entry electronic gate operator assembly.

METAL FINISHES

Galvanizing

Fence, gate and accessories shall be hot-dip galvanized after fabrication conforming to the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Powder Coating

Fence, gate and accessories shall be cleaned and powder coated in accordance with the following requirements:

1. The Contractor shall submit the manufacturer's descriptive data and application instructions to the Engineer for approval.
2. Three samples, 8 inches x 8 inches, with finish color shall be submitted for approval.
3. Furnish Certificates of Compliance to the Engineer for powder coating materials in accordance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.
4. Powder coating shall consist of dry polyester powder electrostatically adhered to metal and baked to form a uniform durable surface.
5. Coating color shall be as shown on the plans.
6. Powder coating shall conform to the following performance criteria:

Property	Reference
Adhesion	ASTM Designation: D 3359B
Pencil hardness	ASTM Designation: D 3363
Flexibility	ASTM Designation: D 522
Impact resistance	ASTM Designation: D 2794, Modified
Abrasion resistance	ASTM Designation: D 4060, Modified
Salt spray resistance	ASTM Designation: B 117
Humidity resistance	ASTM Designation: D 2247

7. All surfaces to be coated shall be cleaned and prepared in accordance with the manufacturer's instructions. Coating shall be applied in a minimum thickness or not less than 0.003 inches and shall form a smooth, uniform surface.

FABRICATION

Gate frames shall be factory fabricated.

Gate frame shall be factory welded.

Holes for attachment of fence and gate shall be predrilled or prepunched prior to galvanizing.

INSTALLATION

The fence and gate shall be installed and fastened in accordance with the details shown on the plans and the approved working drawings.

Excavation and backfill of fence and gate post footings shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications, except for payment.

Bolted and welded connections shall be in accordance with the manufacturer's approved working drawings.

The fence and gate shall be installed plumb and straight. Fence and gate shall not be warped, bowed or twisted.

CLEAN UP AND CLOSE OUT

Adjacent surfaces shall be protected during installation. Fence and gate surfaces shall be cleaned after installation as recommended by the manufacturer.

Surfaces that are abraded or damaged at any time the application of the powder coating shall be repaired as recommended by the manufacturer.

PAYMENT

Ornamental steel fence will be measured and paid for by the linear foot in the same manner specified for chain link fence in Section 80-4.03, "Measurement," and Section 80-4.04, "Payment," of the Standard Specifications.

The contract unit prices paid for the various widths of ornamental pedestrian steel swing gate and 30’ ornamental steel double swing gate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in ornamental steel pedestrian swing gates and 30’ ornamental steel double swing gate, complete in place, including earthwork, minor concrete and reinforcement, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract unit price paid for 30' ornamental steel rolling gate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in 30' ornamental steel rolling gate, complete in place, including earthwork, minor concrete and reinforcement, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for powder coating all ornamental steel fence, swing gate, and rolling gate components shall be considered as included in the contract prices paid for the various items or work involving powder coating and no additional compensation will be allowed therefore.

10-1.45 DIGITAL ENTRY ELECTRONIC GATE CONTROL

The digital entry electronic gate control shall consist of gate operator, loop detectors, access card reader, and appurtenances and shall conform to these special provisions.

OPERATION

When an authorized access card is scanned on the digital entry slotless card reader control unit and the entry loop detector is actuated, the gate shall open for as long as the safety loops are occupied. Any following actuations of the entry loop detector while the gate is open shall reset the closing timer. Once the gate resumes its closing operation, only the actuation of the safety loop detector or the scanning of an authorized access card shall reverse the gate movement.

Exit from the facility shall be through free egress by actuation of the exit loop detector. Any subsequent actuations of the exit loop detector while the gate is open shall reset the closing timer. Actuation of the safety or exit loop detector while the gate is closing shall reverse the movement of the gate.

The gate operator and controls shall be able to operate with a 208 volt (nominal) single phase alternating current input. The Contractor shall provide all necessary equipment including foundations for the gate operator and gooseneck mounting for the digital entry card reader control unit and install all equipment recommended by the manufacturer for the proper operation of the digital entry electronic gate system. The manufacturer's warranty shall be provided to the Engineer.

GATE OPERATOR

The gate operator shall consist of electrical motor, mechanical or hydraulic driver, logic controller, housing and necessary hardware to engage operator to the sliding and rolling gates at the locations shown on the plans. The gate operator shall be enclosed in a weatherproof enclosure and shall meet the following requirements:

A. One horsepower (minimum), reversible motor designed for heavy duty and high frequency usage (30 open/close cycles per hour, minimum).
B. 208 VAC (nominal), single phase operation.
C. Mechanical, electrical and thermal overload protection with automatic reset.
D. Gate travel speed:
   Rolling Gate: 8 inches/sec minimum.
   Swing Gate: 19 seconds per 90 degree opening, minimum.
E. Internal switch to override gate operation (open, close and stop gate).
F. Knox electric switch key, Model 3500 series, single key, as manufactured by Knox Company, 1601 W. Deer Valley Rd, Phoenix, AZ 85027; or equal.

CARD READER

The card reader unit shall be a stand alone programmable card access with a slotless card reader that include a Relay Hold Open feature.

The card reader unit shall be simple to program using a 15-card programming deck, terminal, or personal computer, utilizes a 3-color LED to help during programming mode and shall include the following operating features:

A. Card type: Barium Ferrite
B. Card capacity: 3,500 (1,750 with Anti-Passback feature)
C. Power input: 12 VAC or 12 VDC
D. Relay strike time: 1 to 30 seconds
E. Temperature range: -40°F to 158°F
F. Facility code: up to 3 different codes simultaneously
G. Dimensions: 5 1/2" high, 4 1/2" wide, 4" deep
H. Factory warranty: 1 year

The card reader shall be enclosed in a weatherproof enclosure and galvanized steel box with built-in hood and light, hinged front door for easy circuit board and wiring access. The enclosure shall be provided with scratch-resistant commercial powder-coating.

The Contractor shall furnish the Engineer 25 access cards for each card reader unit installed.

VEHICLE DETECTORS

Vehicle loop detectors and asphaltic concrete sealant for inductive detector loop for gate operators shall conform to the provisions in Section 86-5, "Detectors," of the Standard Specifications and these special provisions.

Slots shall be filled with hot-melt rubberized asphalt sealant.

At the Contractor's option, where a Type E loop is designated on the plans, a Type A or a Type B loop may be substituted.

For Type E detector loops, sides of the slot shall be vertical and the minimum radius of the slot entering and leaving the circular part of the loop shall be 1-1/2 inches. Slot width shall be a maximum of 3/4 inch. Loop wire for circular loops shall be Type 2. Slots of circular loops shall be filled with elastomeric sealant or hot melt rubberized asphalt sealant.

The depth of loop sealant above the top of the uppermost loop wire in the sawed slots shall be 2 inches, minimum.

Slots in asphalt concrete pavement shall be filled with asphaltic concrete sealant as follows:

A. After conductors are installed in the slots cut in the pavement, paint binder (tack coat) shall be applied to the vertical surfaces of slots in conformance with the provisions in Section 39-4.02, "Prime Coat and Paint Binder (Tack Coat)," of the Standard Specifications.
B. Temperature of sealant material during installation shall be above 21°C. Air temperature during installation shall be above 10°C. Sealant placed in the slots shall be compacted by use of a 8-inch diameter by 1/8-inch thick steel hand roller or other tool approved by the Engineer. Compacted sealant shall be flush with the pavement surface. Minimum conductor coverage shall be one inch. Excess sealant remaining after rolling shall not be reused. On completion of rolling, traffic will be permitted to travel over the sealant.

PAYMENT

The contract unit price paid for digital entry electronic gate control shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in digital entry electronic gate control, including loop detectors and access card reader unit, complete in place, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.46 PAINT TRAFFIC STRIPE AND PAVEMENT MARKINGS

Painted traffic stripes (traffic lines) and pavement markings shall be applied in 2-coat, in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the Standard Specifications and these special provisions.

Traffic stripe and pavement marking paint shall conform to the requirements in State Specification No. PTWB-01.

The color of the painted traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6628-01.

Retroreflectivity of the paint traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 250 mcd m^{-2} lx^{-1}. Yellow painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 150 mcd m^{-2} lx^{-1}.

At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of painted traffic stripes and pavement markings. Permanent tape, if used, shall be placed in conformance with the manufacturer's specifications.

If permanent tape is placed instead of painted traffic stripes and pavement markings, the tape will be measured and paid for by the linear foot as paint traffic stripe and by the square foot as paint pavement marking of the number of coats designated in the Engineer's Estimate.

10-1.47 PARKING BUMPER (PRECAST CONCRETE)

Parking bumpers (precast concrete) shall be furnished and installed at the locations and in accordance with the details shown on the plans and these special provisions.

Parking bumpers shall be precast concrete with reinforcement shall be constructed from commercial quality concrete containing not less than 475 pounds of cement per cubic yard and reinforcing steel or shall be of commercially available precast concrete bumpers conforming to the details shown on the plans.

Parking Bumpers shall be 48 inches long, nominal 8 inches wide and 6 inches high with both top longitudinal corners continuously chamfered, and anchor holes 9 inches from each end. Minor variations in cross sectional dimension may be accepted as a substitute in commercially available units provided Engineer’s approval will be obtained.

Parking bumpers shall be anchored with two 3/4-inch diameter reinforcing bars 15 inches in length commercial quality reinforcing steel dowels or mild steel rods. The dowels or rods shall be installed such that the top of the dowels or rods is flush with the top of the parking bumper.

Arrangement of parking bumpers shall be coordinated with the layout of parking stalls and traffic aisles, providing the proper angle to engage wheels and proper location to prevent overtravel of vehicles

Parking bumpers will be measured by the unit as determined from actual count in place.

The contract unit price paid for parking bumper (precast concrete) shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing parking bumper (precast concrete), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

SECTION 10-2 HIGHWAY PLANTING AND IRRIGATION SYSTEMS

10-2.01 GENERAL

The work performed in connection with highway planting and irrigation systems shall conform to the provisions in Section 20, "Erosion Control and Highway Planting," of the Standard Specifications and these special provisions.

The Contractor shall notify the Engineer not less than 72 hours prior to requiring initial access to the existing irrigation controllers. When the Engineer determines that access to the controllers is required at other times, arrangements will be made to provide this access.

When fluctuations of water pressure and water supply are encountered during normal working hours, plants shall be watered at other times, as often, and in sufficient amounts as conditions may require to keep the soil and plant roots moist during the life of the contract.

Full compensation for watering plants outside normal working hours shall be considered as included in the contract lump sum prices paid for highway planting and plant establishment work and no additional compensation will be allowed therefor.

PROGRESS INSPECTIONS

Progress inspections will be performed by the Engineer for completed highway planting and irrigation system work at designated stages during the life of the contract.

Progress inspections will not relieve the Contractor of responsibility for installation in conformance with the special provisions, plans and Standard Specifications. Work within an area shall not progress beyond each stage until the inspection has been completed, corrective work has been performed, and the work is approved, unless otherwise permitted by the Engineer.

The requirements for progress inspections will not preclude additional inspections of work by the Engineer at other times during the life of the contract.

The Contractor shall notify the Engineer, in writing, at least 4 working days prior to completion of the work for each stage of an area and shall allow a minimum of 3 working days for the inspection.

Progress inspections will be performed at the following stages of work:

A. During pressure testing of the pipelines on the supply side of control valves.
B. During testing of low voltage conductors.

C. Before planting begins and after completion of the work specified for planting in Section 20-4.03, "Preparing Planting Areas," of the Standard Specifications.
D. Before plant establishment work begins and after completion of the work specified for planting in Section 20-4.05, "Planting," of the Standard Specifications.
E. At intervals of one month during the plant establishment period.

COST BREAK-DOWN

The Contractor shall furnish the Engineer a cost break-down for the contract lump sum items of highway planting and irrigation system. Cost break-down tables shall be submitted to the Engineer for approval within 30 working days after the contract has been approved. Cost break-down tables will be approved, in writing, by the Engineer before any partial payment will be made for the applicable items of highway planting and irrigation system involved.

Attention is directed to "Time-Related Overhead" of these special provisions regarding compensation for time-related overhead.

Cost break-downs shall be completed and furnished in the format shown in the samples of the cost break-downs included in this section. Line item descriptions of work shown in the samples are the minimum to be submitted. Additional line item descriptions of work may be designated by the Contractor. If the Contractor elects to designate additional line item descriptions of work, the quantity, value and amount for those line items shall be completed in the same manner as for the unit descriptions shown in the samples. The line items and quantities given in the samples are to show the manner of preparing the cost break-downs to be furnished by the Contractor.

The Contractor shall determine the quantities required to complete the work shown on the plans. The quantities and their values shall be included in the cost break-downs submitted to the Engineer for approval. The Contractor shall be responsible for the accuracy of the quantities and values used in the cost break-downs submitted for approval.

The sum of the amounts for the line items of work listed in each cost break-down table for highway planting and for irrigation system work shall be equal to the contract lump sum price bid for Highway Planting and Irrigation System, respectively. Overhead and profit, except for time-related overhead, shall be included in each individual line item of work listed in a cost break-down table.

No adjustment in compensation will be made in the contract lump sum prices paid for highway planting and irrigation system due to differences between the quantities shown in the cost break-downs furnished by the Contractor and the quantities required to complete the work as shown on the plans and as specified in these special provisions.

Individual line item values in the approved cost break-down tables will be used to determine partial payments during the progress of the work and as the basis for calculating an adjustment in compensation for the contract lump sum items of highway planting and irrigation system due to changes in line items of work ordered by the Engineer. When the total of ordered changes to line items of work increases or decreases the lump sum price bid for either Highway Planting or Irrigation System by more than 25 percent, the adjustment in compensation for the applicable lump sum item will be determined in the same manner specified for increases and decreases in the total pay quantity of an item of work in Section 4-1.03B, "Increased or Decreased Quantities," of the Standard Specifications.

HIGHWAY PLANTING COST BREAK-DOWN

Contract No. 08-0H2824

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
ROADSIDE CLEARING	LS	LUMP SUM		
CULTIVATE	SQYD	22,484		
SOIL AMENDMENT	CY	4,626		
MULCH	CY	3,610		
COMMERCIAL FERTILIZER (GRANULAR)	LB	2,252		
PLANT (GROUP A)	EA	1,718		
PLANT (GROUP B)	EA	4,471		
PLANT (GROUP F)	EA	2,911		
PLANT (GROUP K) 24” BOX	EA	59		
PLANT (GROUP K) 48” BOX	EA	1		
PLANT (GROUP M)	EA	19,725		
TURF (HYDROSEED)	SQYD	22,056		
PLANT (GROUP T) TURF (SOD)	SQYD	428		
PLANT (GROUP U)	EA	8		
PLANT (GROUP Z) 15’ DATE PALM	EA	14		
PLANT (GROUP Z) 24" BOX PYGMY DATE PALM	EA	5		

TOTAL _____

IRRIGATION SYSTEM COST BREAK-DOWN

Contract No. 08-0H2824

UNIT DESCRIPTION	UNIT	APPROXIMATE QUANTITY	VALUE	AMOUNT
Control and Neutral Conductors (Armor-Clad)	LS	LUMP SUM		
¾" Plastic Pipe Schedule 40 (Supply Line)	FT	14,000		
1" Plastic Pipe Schedule 40 (Supply Line)	FT	2,815		
1 1/2" Plastic Pipe Schedule 40 (Supply Line)	FT	2,040		
1 1/4" Plastic Pipe Schedule 40 (Supply Line)	FT	4,000		
2" Plastic Pipe Schedule 40 (Supply Line)	FT	4,000		
2" Plastic Pipe Class 315 (Supply Line)	FT	3,975		
2" Electric Remote Control Valve (Master)	EA	1		
1 1/2" Electric Remote Control Valve	EA	28		
1 1/4" Electric Remote Control Valve	EA	13		
1" Electric Remote Control Valve	EA	1		
1 1/2" Quick Coupling Valve	EA	23		
2" Wye Strainer	EA	1		
2" Gate Valve	EA	4		
2" Backflow Preventer Assembly	EA	1		
Backflow Preventer Assembly Enclosure	EA	1		
42 Station Controller (Wall Mount)	EA	1		
Irrigation Controller Enclosure Cabinet (Single)	EA	1		
Flood Bubbler (Type C-2)	EA	316		
Sprinkler (Type B-2)	EA	718		
Gear Driven Rotor (Type A-6)	EA	368		

TOTAL _____

10-2.02 (BLANK)

10-2.03 (BLANK)

10-2.04 HIGHWAY PLANTING

The work performed in connection with highway planting shall conform to the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

HIGHWAY PLANTING MATERIALS

Mulch

Mulch must be wood chips.

Commercial Fertilizer (Granular)

Commercial fertilizer (granular) shall be a pelleted or granular form and shall fall within 20 percent of the following guaranteed chemical analysis:

Ingredient	Percentage
Nitrogen	6
Phosphoric Acid	20
Water Soluble Potash	20

Commercial Fertilizer (Slow Release)

Commercial fertilizer (slow release) used during plant establishment shall be a pelleted or granular form, and shall fall within the following guaranteed chemical analysis range:

Ingredient	Percentage
Nitrogen	9
Phosphoric Acid	9
Water Soluble Potash	9

ROADSIDE CLEARING

Prior to preparing planting areas, mulch areas, or commencing irrigation trenching operations for planting areas, trash and debris shall be removed from the entire project limits, excluding paved areas.

PESTICIDES

Pesticides used to control weeds shall conform to the provisions in Section 20-4.026, "Pesticides," of the Standard Specifications. Except as otherwise provided in these special provisions, pesticide use shall be limited to the following materials:

Cacodylic Acid
Diquat
Fluazifop-butyl
Glyphosate
Isoxaben (Preemergent)
Sethoxydim
Oxadiazon - 50 percent WP (Preemergent)
Oryzalin (Preemergent)
Pendimethalin (Preemergent)
Prodiamine (Preemergent)
Trifluralin (Preemergent)
Ammonium Sulfate
Magnesium Chloride
Melfluidide (Growth regulator)

Napropamide (Preemergent)

Granular preemergents may be used when applied to areas that will be covered with mulch, excluding plant basins. Granular preemergents shall be limited to the following materials:

Dichlobenil (Preemergent)
Oxadiazon (Preemergent)

Granular preemergents shall be applied prior to the application of mulch. Mulch applications shall be completed in these areas on the same working day. Photosensitive dye will not be required.

Glyphosate shall be used to kill stolon type weeds.

Oxadiazon shall be of the emulsifiable concentration or wettable powder type, except when Oxadiazon is used under mulch in conformance with these special provisions.

Prior to the application of preemergents, ground cover plants shall have been planted a minimum of 3 days and shall have been thoroughly watered.

A minimum of 100 days shall elapse between applications of preemergents.

Except for ground cover plants, preemergents shall not be applied within 18 inches of plants.

Growth regulators shall not be applied within 6 feet of trees, shrubs or vines.

Ammonium sulfate and magnesium chloride shall be used only in areas planted to Carpobrotus or Delosperma. Ammonium sulfate and magnesium chloride shall not be applied in a manner that allows the pesticides to come in contact with trees or shrubs.

If the Contractor elects to request the use of other pesticides on this project, the request shall be submitted, in writing, to the Engineer not less than 15 days prior to the intended use of the other pesticides. Except for the pesticides listed in these special provisions, no pesticides shall be used or applied without prior written approval of the Engineer.

Pesticides shall not be applied within the limits of the plant basins. Pesticides shall not be applied in a manner that allows the pesticides to come in contact with the foliage and woody parts of the plants.

PREPARING PLANTING AREAS

Plants adjacent to drainage ditches shall be located so that, after construction of the basins, no portion of the basin walls shall be less than 10 feet from the flow line of graded ditches or less than 8 feet from the edge of paved ditches.

CULTIVATE

Areas to be planted with turf (hydroseed) and turf (sod) shall be cultivated.

Immediately prior to cultivation, soil amendment and commercial fertilizer shall be added to the areas to be cultivated. For turf (hydroseed) planting areas, soil amendment shall be added at the rate of 2 cubic yards per 100 square feet and commercial fertilizer shall be applied at the rate of 7.0 pounds per 1,000 square feet. Soil amendment and commercial fertilizer for the turf (sod) planting areas shall be added at the rates shown on the plans. Soil amendment and fertilizer shall be thoroughly mixed with the soil.

After cultivation is complete and the irrigation systems have been installed and the plant holes have been excavated and backfilled, no further planting work shall be done in the cultivated areas for a period of 20 days, except the soil shall be kept sufficiently moist to germinate weeds. Weeds that germinate shall be killed.

PLANTING

Backfill material for plant holes shall be a mixture of soil and soil amendment. The quantity of soil amendment shall be as shown on the Plant List. Soil amendment shall conform to the provisions in Section 20-2.03, "Soil Amendment," of the Standard Specifications. Backfill material shall be thoroughly mixed and uniformly distributed throughout the entire depth of the plant hole without clods and lumps.

Commercial fertilizer (pelleted and granular) shall be applied or placed at the time of planting and at the rates shown on the Plant List and in conformance with the provisions in Section 20-4.05, "Planting," of the Standard Specifications and these special provisions.

A granular preemergent shall be applied to areas to be covered with mulch outside of plant basins in conformance with the provisions in "Pesticides" of these special provisions.

Mulch shall be placed in all planting areas and tree planting areas. Mulch placed in areas outside of plant basins shall be spread to a uniform depth of 2 inches. No mulch shall be placed in turf (hydroseed) and turf (sod) planting areas.

Mulch shall be spread from the outside of the proposed plant basin to the adjacent edges of curbs, sidewalks, walls, and fences as shown on the plans. If the proposed plant material is 12 feet or more from the adjacent edges of curbs, sidewalks, walls, and fences the mulch shall be spread 6 feet beyond the outside edge of the proposed plant basins.

Mulch shall not be placed within 3 feet of the centerline of earthen drainage ditches, within 3 feet of the edge of paved ditches, and within 3 feet of the centerline of drainage flow lines.

Attention is directed to "Irrigation Systems Functional Test" of these special provisions regarding functional tests of the irrigation systems. Planting shall not be performed in an area until the functional test has been completed for the irrigation system serving that area.

LINER PLANTS

Liner plants shall be furnished in containers with a minimum size of 2-1/4" x 2-1/4" x 3" deep. Liner plant containers made of biodegradable material shall not be used. All liner plants shall be removed from their containers at the time of planting.

At the option of the Contractor, seedling plants may be furnished in lieu of liner plants. Seedling plants shall be bare root.

Liner plants shall not be planted until the soil is moist to a minimum depth of 8 inches, unless otherwise approved in writing by the Engineer.

Planting holes for liner plants shall be large enough to accommodate the total length and width of the roots and soil amendments.

TURF (HYDROSEED)

Turf (hydroseed) shall be applied to the areas shown on the plans as "Turf (Hydroseed)."

Areas to receive turf (hydroseed) shall be cultivated in conformance with the provisions in "Cultivate" of these special provisions.

Weeds and debris shall be removed before cultivation and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Soil amendment and commercial fertilizer shall be applied in conformance with the provisions in "Cultivate" of these special provisions.

MATERIALS

Materials must comply with Section 20-2, "Materials," of the Standard Specifications and these special provisions.

Seed

Seed must comply with Section 20-2.10, "Seed," of the Standard Specifications. Seed not required to be labeled under the California Food and Agricultural Code shall be tested for purity and germination by a seed laboratory certified by the Association of Official Seed Analysts or by a seed technologist certified by the Society of Commercial Seed Technologists. Measure and mix individual seed species in the presence of the Engineer.

Seed must contain at most 1.0 percent total weed seed by weight.

Deliver seed to the job site in unopened separate containers with the seed tag attached. Containers without a seed tag attached are not accepted. The Engineer takes a sample of approximately 1 ounce or 0.25 cup of seed for each seed lot greater than 2 pounds.

Seed must comply with the following:

Seed

Botanical Name (Common Name)	Percent Germination (Minimum)	Pounds Pure Live Seed Per Acre (Slope Measurement)
*Festuca Arondinacea Tall Fescue	85	500

*Seed produced in California only.

Seed Sampling Supplies

At the time of seed sampling, provide the Engineer a glassine lined bag and custody seal tag for each seed lot sample.

Commercial Fertilizer

Commercial fertilizer must comply with Section 20-2.02, "Commercial Fertilizer," of the Standard Specifications and have a guaranteed chemical analysis within 2 percent of 6 percent nitrogen, 20 percent phosphoric acid and 20 percent water soluble potash.

APPLICATION

Apply the following turf (hydroseed) mixture with hydroseeding equipment at the rates indicated within 60 minutes after the seed has been added to the mixture:

Material	Pounds Per Acre (Slope Measurement)
Seed	500
Fiber	500
Commercial Fertilizer	300

The Engineer may change the rates of turf (hydroseed) materials to meet field conditions.

If irregular or uneven areas appear before or during the plant establishment period, these areas shall be restored to a smooth and even appearance and the turf (hydroseed) shall be reapplied.

When the turf (hydroseed) has reached a height of 4 inches the turf shall be mowed to a height of 2 inches. Turf (hydroseed) edges, including edges adjacent to sidewalks and other paved borders and surfaced areas, shall be trimmed to a uniform edge not extending beyond the edge of turf or the facilities. Mowed and trimmed growth shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Trimming shall be repeated whenever the edge of turf exceeds one inch.

Mowing and trimming turf (hydroseed) and disposing of mowed material, during the plant establishment period, will be paid for in conformance with the provisions in "Plant Establishment Work" of these special provisions.

TURF (SOD)

Turf (sod) shall be placed on the areas shown on the plans as "Turf (Sod)."

Sod shall be a mixture of "Tall Fescue" varieties, and shall be healthy field grown sod containing not more than 1/2 inch thick thatch. The age of the sod shall be not less than 8 months or more than 16 months.

Sod shall be grown in conformance with California agricultural codes. The sod shall be free from disease, weeds, insects, and nondesirable types of grasses and clovers. Soil upon which the sod has been grown shall contain less than 50 percent silt and clay.

Sod shall be machine cut at a uniform soil thickness of 5/8 inch ± 1/4 inch, not including top growth and thatch.

A Certificate of Compliance for the sod shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Sod shall be protected with tarps or other protective covers during delivery and shall not be allowed to dry out during delivery or prior to placement.

Areas to be planted to sod shall be cultivated in conformance with the provisions in "Cultivate" of these special provisions.

Weeds and debris shall be removed before cultivation and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

Soil amendment and commercial fertilizer shall be applied at the rates shown on the plans and in conformance with the provisions in "Cultivate" of these special provisions.

After cultivation, installation of irrigation systems, and excavation and backfilling of plant holes are completed, areas to be planted to sod shall be fine graded and rolled. Areas to be planted to sod shall be graded to drain and shall be smooth and uniform prior to placing sod. Areas to be planted to sod adjacent to sidewalks and other paved borders and surfaced areas shall be 1-1/2 inches ± 1/4 inch below the top grade of the facilities, after fine grading, rolling, and settlement of the soil.

Sod shall be placed so that the ends of adjacent strips of sod are staggered a minimum of 2 feet. Edges and ends of sod shall be placed firmly against adjacent sod and against sidewalks and other paved borders and surfaced areas.

After placement of the sod, the entire sodded area shall be lightly rolled to eliminate air pockets and to ensure close contact with the soil. After rolling, the sodded areas shall be watered so that the soil is moistened to a minimum depth of 4 inches. Sod shall not be allowed to dry out.

If irregular or uneven areas appear before or during the plant establishment period, these areas shall be restored to a smooth and even appearance.

When the turf (sod) has reached a height of 4 inches the turf shall be mowed to a height of 2 inches. Turf (sod) edges, including edges adjacent to sidewalks, concrete headers, and other paved borders and surfaced areas, shall be trimmed to a uniform edge not extending beyond the edge of turf or the facilities. Mowed and trimmed growth shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Trimming shall be repeated whenever the edge of turf exceeds one inch.

Mowing and trimming turf (sod) and disposing of mowed material, during the plant establishment period, will be paid for in conformance with the provisions in "Plant Establishment Work" of these special provisions.

PLANT ESTABLISHMENT WORK

The plant establishment period shall be Type 2 and shall not be less than 250 working days.

Attention is directed to "Relief From Maintenance and Responsibility" in these special provisions regarding relief from maintenance and protection.

Commercial fertilizer (slow release) shall be applied to trees, shrubs, vines, ground cover, turf (hydroseed), and turf (sod) during the first week of March, June and September of each year. Commercial fertilizer shall be applied at the rates shown on the plans. Commercial fertilizer for turf (hydroseed) shall be applied at the rate of 7.0 pounds per 1,000 square feet. Commercial fertilizer shall be spread with a mechanical spreader wherever possible.

The center to center spacing of replacement plants for unsuitable ground cover plants shall be determined by the number of completed plant establishment working days at the time of replacement and the original spacing in conformance with the following:

ORIGINAL SPACING (Inches)	SPACING OF REPLACEMENT GROUND COVER PLANTS (Inches)		
	Number of Completed Plant Establishment Working Days		
	1-125	126-190	191-End of Plant Establishment
9	9	6	6
12	12	9	6
18	18	12	9
24	24	18	12
36	36	24	18

Weeds within plant basins, including basin walls and ground cover, shall be controlled by hand pulling.

Weeds within mulched and ground cover areas and outside of plant basins shall be controlled by killing.

Weeds within pavement, curbs, sidewalk, and other surfaced areas shall be controlled by killing.

Vines shall be trained onto fences and walls or through cored holes in walls.

At the option of the Contractor, a growth regulator may be applied to mowed areas, provided the growth regulator is approved in advance by the Engineer and the growth regulator is applied in conformance with these special provisions. If a growth regulator is approved and applied, the growth regulator shall be at the Contractor's expense.

At the option of the Contractor, plants of a larger container size than those originally specified may be used for replacement plants during the first 125 working days of the plant establishment period. The use of plants of a larger container size than those originally specified for replacement plants shall be at the Contractor's expense.

After 125 working days of the plant establishment period have been completed, replacement of plants, except for ground cover plants, shall be one-gallon size for seedlings, pot and liner size plants; 5-gallon size for one-gallon size plants; 15-gallon size for 5-gallon size plants; and other plant replacement plants shall be the same size as originally specified.

When ordered by the Engineer, one application of a preemergent pesticide conforming to the provisions in "Pesticides" of these special provisions, shall be applied between 40 working days and 50 working days prior to completion of the plant establishment period. This work will be paid for as extra work as provided in Section 4-1.03D,"Extra Work," of the Standard Specifications.

Wye strainers shall be cleaned at least 15 days prior to the completion of the plant establishment period.

The final inspection shall be performed in conformance with the provisions in Section 5-1.13, "Final Inspection," of the Standard Specifications and shall be completed a minimum of 20 working days before the estimated completion of the contract.

Turf areas shall be mowed in conformance with the provisions in "Turf (Hydroseed)" and "Turf (Sod)" of these special provisions.

Full compensation for mowing and trimming turf (hydroseed) and turf (sod) and disposing of mowed and trimmed material during the plant establishment period shall be considered as included in the contract lump sum price paid for plant establishment work and no additional compensation will be allowed therefor.

10-2.05 IRRIGATION SYSTEMS

Irrigation systems shall be furnished and installed in conformance with the provisions in Section 20-5, "Irrigation Systems," of the Standard Specifications, except materials containing asbestos fibers shall not be used.

Attention is directed to the provisions in "Obstructions" of these special provisions, regarding work over or adjacent to existing underground facilities. Excavation for proposed irrigation facilities shall not be started until the existing underground facilities have been located.

Method A pressure testing shall conform to the provisions in Section 20-5.03H(1), "Method A", of the Standard Specifications, except leaks that develop in the tested portion of the system shall be located and repaired after each test period when a drop of more than 5 pounds per square inch is indicated by the pressure gage. After the leaks have been repaired, the one hour pressure test shall be repeated and additional repairs made until the drop in pressure is 5 pounds per square inch or less.

VALVE BOXES

Valve boxes shall conform to the provisions in Section 20-2.24, "Valve Boxes," of the Standard Specifications, except as otherwise provided herein.

Valve boxes shall be precast portland cement concrete.

Covers for concrete valve boxes shall be cast iron or steel.

Valve boxes shall be identified on the top surface of the covers by labels containing the appropriate abbreviation for the irrigation facility contained in the valve box as shown on the plans. Valve boxes that contain remote control valves shall be identified by the appropriate letters and numbers (controller and station numbers). Labels for valve boxes shall conform to the provisions in Section 20-5.03F, "Valves and Valve Boxes," of the Standard Specifications.

Label material shall be plate plastic or polyurethane.

GATE VALVES

Gate valves shall be as shown on the plans and in conformance with the provisions in Section 20-2.28, "Gate Valves," of the Standard Specifications and these special provisions.

Gate valves shall have a solid bronze.

ELECTRIC AUTOMATIC IRRIGATION COMPONENTS

Irrigation Controllers

Irrigation controllers shall be single, solid-state independent controllers conforming to the following:

A. Irrigation controllers shall be fully automatic and shall operate a complete 14-day or longer irrigation program.
B. A switch or switches shall be provided on the face of the control panel that will turn the irrigation controller "on" or "off" and provide for automatic or manual operation. Manual operation shall allow cycle start at the desired station and shall allow activation of a single station.
C. The watering time of each station shall be displayed on the face of the control panel.
D. The irrigation controller and the low voltage output source shall be protected by fuses or circuit breakers.
E. The irrigation controller mechanism, panel and circuit board shall be connected to the low voltage control and neutral conductors by means of plug and receptacle connectors located in the irrigation controller enclosure.
F. Each station shall have a variable or incremental timing adjustment with a range of 1440 minutes to a minimum of one minute.
G. Irrigation controllers shall be capable of a minimum of 4 program schedules.
H. Irrigation controllers shall have an output that can energize a pump start circuit or a remote control valve (master).
I. When 2 or more irrigation controllers operate the same electric remote control valve (master), an isolation relay shall be provided and installed per the controller manufacturer's instructions.
J. Irrigation controllers shall be manufactured by the same company.
K. Where direct burial conductors are to be connected to the terminals strip, the conductors shall be connected with the proper size open-end crimp-on wire terminals. No exposed wire shall extend beyond the crimp of the terminal and the wires shall be parallel on the terminal strip.

Attention is directed to the provisions in "Electric Service (Irrigation)" of these special provisions regarding electrical power for irrigation controllers and irrigation controller enclosure cabinets.

Electric Remote Control Valves

Electric remote control valves shall conform to the provisions in Section 20-2.23, "Control Valves," of the Standard Specifications and the following:

A. Valves and bonnet shall be brass.
B. Valves shall be angle pattern (bottom inlet) or straight pattern (side inlet) as shown on the plans.

Pull Boxes

Pull box installations shall conform to the provisions in Section 20-5.027I, "Conductors, Electrical Conduits and Pull Boxes," of the Standard Specifications.

Conductors

Low voltage, as used in this section "Conductors," shall mean 36 V or less. Conductor shall be #14 minimum.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked with adhesive cloth wrap-around markers.

Low voltage control and neutral conductors in pull boxes and valve boxes, at irrigation controller terminals, and at splices shall be marked as follows:

A. Conductor terminations and splices shall be marked with adhesive backed paper markers or adhesive cloth wrap-around markers, with clear, heat-shrinkable sleeves sealed over the markers.

Markers for the control conductors shall be identified with the appropriate number or letter designations of irrigation controllers and station numbers. Markers for neutral conductors shall be identified with the appropriate number or letter designations of the irrigation controllers.

The color of low voltage neutral and control conductor insulation, except for the striped portions, shall be homogeneous throughout the entire thickness of the insulation.

Insulation for conductors may be UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 41 mils for wire sizes 10AWG and smaller.

ARMOR-CLAD CONDUCTORS

Armor-clad conductors shall be used in direct burial applications from pull boxes adjacent to irrigation controller to remote control valves and other irrigation facilities in conformance with the details shown on the plans and these special provisions.

Armor-clad conductors shall conform to the following:

A. Conductors shall be the proper size for the application, and shall be solid, uncoated copper with a conductor size not less than 90 percent of the AWG diameter required.
B. At the Contractor's option, conductor insulation coverings shall be either of the following:

    1. Polyvinyl chloride (PVC) conforming to UL style, Type UF 60°C, 600 V. Average thickness of insulation shall be not less than 60 mils, with a minimum thickness of 54 mils, or
    2. UL listed polyethylene conforming to UL44 test standards with a minimum insulation thickness of 41 mils for wire sizes 10AWG and smaller.

C. Armor shall be a minimum 0.005-inch thick by 0.50-inch wide Type 304 stainless steel tape that is helically wrapped over each conductor with a 33 percent minimum overlap.
D. Outer jacket for conductors shall be sunlight resistant PVC and shall conform to the Insulated Power Cable Engineer's Association (ICEA) S-61-402, NEMA Standard WC5, and UL Listing 1263. Nominal thickness of the outer jacket shall be 30 mils with a minimum thickness of 24 mils.

IRRIGATION CONTROLLER ENCLOSURE CABINET

Irrigation controller enclosure cabinets shall be constructed and equipment installed in the cabinets in conformance with the details shown on the plans, the provisions of Section 86-3.04A, "Cabinet Construction," of the Standard Specifications, and these special provisions.

Electric service shall be installed in accordance with "Electric Service (Irrigation)" of these special provisions.

Irrigation controller enclosure cabinets shall be provided with cross ventilation, roof ventilation or a combination of both. The ventilation shall not compromise the weather resistance properties of the irrigation controller enclosure cabinets and shall be fabricated by the manufacturer.

The anchorage arrangement shall be inside the cabinet as shown on the plans. Dimensions of the cabinet shall be suitable for the equipment to be installed as shown on the plans and specified in these special provisions.

Irrigation controller enclosure cabinet dimensions for a single irrigation controller shall be 60 inches (Height) x 36 inches (Width) x 12 inches (Depth).

Irrigation controller enclosure cabinets shall be fabricated in conformance with the provisions in Section 86-3.04A, "Cabinet Construction," of the Standard Specifications.

Irrigation controller enclosure cabinets shall be fabricated of stainless steel.

Irrigation controller enclosure cabinet doors shall not be furnished with integral door locks. Irrigation controller enclosure cabinet door handles shall have provisions for padlocking in the latched position. Padlocks will be State-furnished as provided under "State-Furnished Materials" of these special provisions.

Mounting panels shall be fabricated of 3/4 inch exterior AC grade veneer plywood. The panels shall be painted with one application of an exterior, latex based, wood primer and two applications of an exterior, vinyl acrylic enamel, white in color. The panels shall be painted on all sides and edges before installation of the panels in the cabinets and the equipment on the panels.

Inside of the doors shall have provisions for storage of the irrigation plans.

Solid-state automatic shut-off rain sensor units shall be installed for the irrigation controller enclosure cabinets. Rain sensor units shall automatically interrupt the master remote control valves when approximately 1/8 inch of rain has fallen. The irrigation system shall automatically be enabled again when the accumulated rainfall evaporates from the rain sensor unit collection cup. Rain sensor units shall be rated 24 V (ac) to 30 V (ac). Static charge protection shall be included to protect against lightning damage.

Equipment, except for field wiring, shall be installed in the cabinet in a shop prior to field installation.

IRRIGATION SYSTEMS FUNCTIONAL TEST

Functional tests for the irrigation controllers and associated automatic irrigation systems shall conform to the provisions in Section 20-5.027J, "Testing," of the Standard Specifications and these special provisions.

Tests shall demonstrate to the Engineer, through one complete cycle of the irrigation controllers in the automatic mode, that the associated automatic components of the irrigation systems operate properly. If automatic components of the irrigation systems fail a functional test, these components shall be repaired at the Contractor's expense and the testing repeated until satisfactory operation is obtained.

Associated automatic components shall include, but not be limited to, remote control valves, and rain sensors.

Upon completion of work on an irrigation system, including correction of deficiencies and satisfactory functional tests for the systems involved, the plants to be planted in the area watered by the irrigation system may be planted provided the planting areas have been prepared as specified in these special provisions.

PIPE

Steel Pipe

Galvanized steel pipe supply lines installed between water meters and backflow preventer assemblies shall be installed not less than 30 inches below finished grade, measured to the top of the pipe.

Plastic Pipe

Plastic pipe supply lines shall be polyvinyl chloride (PVC) 1120 or 1220 pressure rated pipe with the minimum pressure rating (PR) shown in the special provisions.

Plastic pipe supply lines less than 4 inches in diameter shall have solvent cemented type joints. Primers shall be used on the solvent cemented type joints.

Plastic pipe supply lines (main) shall have a minimum cover of 1.5 feet.

Plastic pipe supply lines downstream from the remote control valves for Type C sprinklers shall have a minimum cover of 6 inches.

A nonhardening joint compound shall be used in place of the pipe thread sealant tape conforming to the provisions in Section 20-5.03E, "Pipe," of the Standard Specifications. Joint compounds shall be applied in conformance with the manufacturer's recommendations.

Fittings for plastic pipe supply lines with a pressure rating (PR) of 315 shall be Schedule 80.

BACKFLOW PREVENTER ASSEMBLIES

Backflow preventers shall conform to the provisions in Section 20-2.25, "Backflow Preventers," of the Standard Specifications and these special provisions.

Backflow preventers assemblies shall be of the approved type reduced pressure principle devices listed by the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section, 2525 Corporate Place, Monterey Park, California 91754, Telephone (213) 881-4140.

Before backflow preventer assembly installation, the Contractor shall provide the Engineer with the portion of the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section. "List of Approved Backflow Prevention Assemblies" showing type of assembly, manufacturer's name, model number, edition of the manual under which the assembly was approved, approval date and the last renewal date.

Pressure loss through the backflow preventers shall not exceed the following:

BACKFLOW PREVENTER SIZE (inches)	FLOW RATE (Gallons per minute)	PRESSURE LOSS (psi)
2	50	12

Backflow preventer assemblies shall be painted with a minimum of 2 applications of a commercial quality enamel paint. The color of the paint shall be green, matching Federal standard #595 B, color #24108.

BACKFLOW PREVENTER ASSEMBLY ENCLOSURE

Enclosures shall be fabricated of structural steel angles and flattened expanded metal and shall be installed over backflow preventer assemblies on a portland cement concrete pad as shown on the plans and in conformance with these special provisions.

Expanded metal for sides, ends and top panels shall be fabricated from 14-gage minimum thickness, sheet steel. The flattened expanded metal openings shall be approximately 3/4" x 1-3/4" in size.

Expanded metal panels shall be attached to the steel frames by a series of welds, not less than 1/4 inch in length and spaced not more than 4 inches on centers, along the edges of the enclosure.

Padlocks will be State-furnished in accordance with "State-furnished Materials" of these special provisions.

Enclosures shall be galvanized, after fabrication, in conformance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Enclosures shall be painted with one application of a commercial quality pre-treatment, vinyl wash primer and a minimum of one application of a commercial quality, exterior enamel for metal. The finish color shall be green, matching Federal standard #595 B, color #24108.

All parts of the backflow preventer assembly enclosure, including hold down assemblies, may be constructed of stainless steel instead of standard steel materials specified above. Stainless steel enclosures shall conform to the provisions herein except galvanizing, priming and painting shall not be required. Stainless steel enclosures shall be powder coated a green color, matching Federal standard #595 B, color #24108, by the manufacturer.

The minimum clearance between the backflow preventer assembly and the backflow preventer assembly enclosure shall be 2 inches.

TESTING NEW BACKFLOW PREVENTERS

New backflow preventers shall be tested for proper operation in conformance with the provisions in Section 20-5.03J, "Check and Test Backflow Preventers," of the Standard Specifications and these special provisions.

Tests for new backflow preventers shall be satisfactorily completed after installation and before operation of the irrigation systems.

New backflow preventers shall be retested one year after the satisfactory completion of the previous test, and each year thereafter until the plant establishment period is completed. An additional test shall be provided not more than 10 days prior to acceptance of the contract.

SPRINKLERS

Sprinklers shall conform to the type, pattern, material, and operating characteristics listed in the "Sprinkler Schedule" shown on the plans.

WYE STRAINERS

Wye strainers shall be installed on the upstream side of the electric remote control valves as shown on the plans.

Removable stainless steel strainers for wye strainers shall be 40 size mesh.

When garden valves are opened, discharge shall be up and out of the valve box.

Full compensation for garden valves and pipe fittings for garden valves on wye strainers shall be considered as included in the contract lump sum price paid for irrigation system and no additional compensation will be allowed therefor.

FINAL IRRIGATION SYSTEM CHECK

A final check of existing and new irrigation facilities shall be performed not more than 40 working days and not less than 30 working days prior to acceptance of the contract.

The length of watering cycles using potable water measured by water meters for the final check of irrigation facilities will be determined by the Engineer.

Remote control valves connected to existing and new irrigation controllers shall be checked for automatic performance when the controllers are in automatic mode.

Unsatisfactory performance of irrigation facilities installed or modified by the Contractor shall be repaired and rechecked at the Contractor's expense until satisfactory performance is obtained, as determined by the Engineer.

Repair or replacement of existing irrigation facilities due to unsatisfactory performance shall conform to the provisions in "Existing Highway Irrigation Facilities" of these special provisions.

Nothing in this section "Final Irrigation System Check" shall relieve the Contractor of full responsibility for making good or repairing defective work or materials found before the formal written acceptance of the entire contract by the Director.

Full compensation for checking the irrigation systems prior to the acceptance of the contract shall be considered as included in the contract lump sum price paid for plant establishment work and no additional compensation will be allowed therefor.

SECTION 10-3. LIGHTING AND ELECTRICAL SYSTEMS

10-3.01 DESCRIPTION

Gate operator electric service, site lighting and site electrical system shall conform to the provisions in Section 86, "Signals, Lighting and Electrical Systems," of the Standard Specifications and these special provisions.

10-3.02 COST BREAK-DOWN

Cost break-downs shall conform to the provisions in Section 86-1.03, "Cost Break-Down," of the Standard Specifications and these special provisions.

The Engineer shall be furnished a cost break-down for each contract lump sum item of work described in this Section 10-3.

The cost break-down shall be submitted to the Engineer for approval within 15 days after the contract has been approved. The cost break-down shall be approved, in writing, by the Engineer before any partial payment for the items of electrical work will be made.

The cost break-down shall include the following items in addition to those listed in the Standard Specifications:

A. Utility ducts (Site Electrical)
B. Duct bank reinforced concrete encasement

10-3.03 FOUNDATIONS

Reinforced cast-in-drilled-hole concrete pile foundations for lighting electoliers shall conform to the provisions in "Piling" of these special provisions, except payment.

Concrete foundations shall be as shown on the plans. Anchor bolts or devices shall be accurately located and positioned to match the holes in the pole base plates. Pole and luminaire orientation shall be as indicated on the plans.

10-3.04 ELECTROLIERS, UP LIGHTING AND BOLLARD LIGHTING

Electroliers, up lighting, and bollard lighting shall conform to the provisions in Section 86-2.04, "Standards, Steel Pedestals and Posts," of the Standard Specifications, "Steel Structures" of these special provisions, and the following requirements.

Steel bolts not designated on the plans as high-strength (HS) or stainless steel shall be for general applications and shall conform to the requirements in ASTM Designation: A 307.3

Handhole reinforcement rings for light poles shall be continuous around the handholes.

The types of poles, luminaries and fixtures for electroliers, up lighting and bollard lighting shall conform to the following:

ELECTROLIERS

H4: 175-watt metal halide UL listed luminaire, with integral 277-volt ballast and full cut-off type III distribution mounted on 20-foot pole. The luminaire shall be Bega Catalog No. 8293MH- SLV. The pole shall be Bega Catalog No 1908HR- SLV. Alternate shall be Vektor Catalog No. VE2-R2-1-H175-SV with pole AT535-20-SV or Novara Catalog No. NV450S-P-150-MH-SG with pole 20RS-SG.

Poles for electroliers shall have 48,000 psi minimum yield strength,The poles shall be able to withstand stressed produced by steady state wind with velocity of 100 miles per hour. Pole shall have hand hole with cover plate, base plate and all necessary hardware.

The poles for pole mounted type fixtures shall be mounted rigidly and securely on the foundations as recommended by the fixture and pole manufacturer.

UP LIGHTING

H6: 35 watt metal halide UL listed in-ground mounting luminaire, 277-volt, complete with rock guard, and 35W metal halid lamp . The luminaire shall have spot optics and bronze finish. The luminaire shall be Hadco Catalog No. I3GHSP35HH.. Alternate shall be Kim Catalog No. LTV769-SP-35PMH-277-RG60 or Exterieur Vert Catalog No SPITPA-T6-005-39-7-2-3-ICP3-EV-JB2B-1/2-ICCRBS.

H6A: 35-watt metal halide UL listed in-ground mounting luminaire, 277-volt, complete with rock guard and 35W metal halide lamp. The luminaire shall have flood optics and bronze finish. The luminaire shall be Hadco Catalog No. I3GH35HH. Alternate shall be Kim Catalog No. LTV769-NF-35PMH-277-RG60 or Exterieur Vert Catalog No SPITPA-T6-030-39-7-2-3-ICP3-EV-JB2B-1/2-ICCRBS.

BOLLARD LIGHTING

H7: 70-watt metal halide UL listed luminaire, with integral 277-volt ballast and symmetrical distribution. The luminaire shall have sandstone finish. The bollard pedestal and luminaire shall be Hadco Catalog No. F9ST070HH. Alternate shall be Kim Catalog No. VRB1C-70MH277-CC-C or AAL Catalog No. CB9R-38-DOME-70MH-MSB-CUSTOM.

In the pull box adjacent to each pole for luminaire, a fused splice connector shall be installed in each ungrounded conductor between the line and the ballast. The connector shall be readily accessible in the pull box and shall be insulated and made waterproof in accordance with the splice connector manufacturer's recommendations.

10-3.05 CONDUIT

Conduit to be installed underground shall be Type 3 unless otherwise specified.

Conduit runs shown on the plans for site electrical (power and telephone) shall be provided with reinforced concrete encasement. Concrete for conduit duct bank encasement shall conform to the requirements in Section 66-1.045, "Concrete Backfill," of the Standard Specifications. Reinforcing steel for duct bank encasement reinforcement shall conform to "Reinforcement" of these special provisions.

10-3.06 CONDUCTORS AND WIRING

Splices shall be insulated by "Method B".

10-3.07 BONDING AND GROUNDING

Bonding and grounding shall conform to the provisions in Section 86-2.10, "Bonding and Grounding," of the Standard Specifications and these special provisions.

Bonding jumpers in standards with handholes and traffic pull box lid covers shall be attached by a UL listed lug using 3/16-inch diameter or larger brass or bronze bolts and shall run to the conduit or bonding wire in the adjacent pull box. The grounding jumper shall be visible after the standard has been installed and the mortar pad and cap have been placed on the foundation.

Standards without handholes shall have bonding accomplished by jumpers attached to UL listed ground clamps on each anchor bolt.

For slip base standards or slip base inserts, bonding shall be accomplished by jumpers attached to UL listed ground clamps on each anchor bolt, or a UL listed lug attached to the bottom slip base plate with a 3/16-inch diameter or larger brass or bronze bolt.

Equipment bonding and grounding conductors are required in all conduits, except when the conduits contain fiber optic cable, . A No. 8 minimum, bare copper wire shall run continuously in circuits, except for series lighting circuits, where No. 6 bare copper wire shall run continuously. The bonding wire size shall be increased to match the circuit breaker size in conformance with the Code, or shall be as shown on the plans. Conduits to be installed for future conductors, may omit the copper wire.

Bonding of metallic conduits in metal pull boxes shall be by means of bonding bushings and bonding jumpers connected to the bonding wire running in the conduit system.

10-3.08 PAYMENT

The contract lump sum price paid for site electrical shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in conduits for site electrical facilities, complete in place, including earthwork, concrete encasement and grounding conductor, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

The contract lump sum price paid for site lighting shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in conduits for site electrical, complete in place, including earthwork, concrete encasement and grounding conductor, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and installing up lighting and bollard lighting shall be considered as included in the contract lump sum price paid for site lighting and no separate payment will be made therefore.

Full compensation for gate operator electric service shall be considered as included in the contract lump sum price paid for site lighting and no separate payment will be made therefore.

SECTION 10-4. SITE UTILITIES

10-4.01 DESCRIPTION

This work shall consist of furnishing and constructing utility pipes, structures and other appurtenances for water supply system, sanitary sewer and building drain disposal system, and natural gas supply line system, in accordance with the Standard Specifications, these special provisions, and as directed by the Engineer.

10-4.02 WATER SUPPLY SYSTEM

This work shall consist of furnishing and installing a complete water supply system, including fire service facilities, in accordance with the details shown on the plans and these special provisions.

The water supply system shall include all equipment, accessories and appurtenances necessary for the complete installation and operation of said system.

Earthwork, foundations, supports, sheet metal, painting, mechanical, electrical, and all other work incidental to and necessary for the proper installation and operation of the water supply system shall conform to the requirements for similar work elsewhere in these special provisions

SUBMITTALS

Working drawings, material lists, descriptive data, and other submittals specified herein shall be submitted for approval in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

Unless otherwise permitted in writing by the Engineer, all submittals required by these special provisions shall be submitted within 35 days after the Contractor has received notice that the contract has been approved.

Attention is directed to the provisions in Section 5-1.01, "Authority of Engineer," of the Standard Specifications. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Attention is directed to Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications. The second indented paragraph of the first paragraph of said Section 6-1.05 is amended to read:

> "Whenever the specifications permit the substitution of a similar or equivalent material or article, no tests or action relating to the approval of such substitute material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made within a time period not to exceed 35 days after the date on which the contract has been approved, shall be made in ample time to permit approval without delaying the work, but need not be made in less than 35 days after award of the contract."

Work requiring the submittal of working drawings, material lists, descriptive data, or other submittals shall not begin prior to approval of said submittal by the Engineer. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time allowance and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

Each submission of drawings, material lists and descriptive data shall consist of at least 5 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall not be larger than 22" x 36".

Working drawings shall show complete layout and details of the equipment and materials to be installed.

The material list and descriptive data shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent performance ratings, and identification symbols used on the plans and in the special provisions for each unit.

The material list and descriptive data submittals shall include, but not necessarily be limited to, the following:

1. Fire Hydrant
2. Backflow Preventer Assemblies
3. Water Supply Main and Line Valves,
4. Fire Hydrant and Post Indicator Valves
5. Tamper Resistant Switch
6. Valve Box Assemblies

Parts lists and service instructions packaged with or accompanying the equipment installed in the work shall be delivered to the Engineer at the jobsite.

Before completion of the project, 3 bound identified copies of the operation and maintenance instructions and parts lists for equipment furnished shall be delivered to the Engineer at the jobsite. Manuals that are inadequate or incomplete will be returned and the Contractor shall resubmit adequate and complete manuals. Manuals shall be included for the following equipment:

1. Fire Hydrant
2. Backflow Preventer Assemblies
3. Water Supply Main Valves,
4. Fire Hydrant and Post Indicator Valves
5. Tamper Resistant Switch

Manufacturer's warranties and guarantees for equipment and materials installed in the work shall be delivered to the Engineer at the jobsite.

MATERIALS

Piping:

Polyvinyl chloride (PVC) pressure plastic pipe and fittings for domestic water supply and fire service lines shall conform to AWWA Designation: C900, Class 200, Pipe shall be fabricated from material conforming to ASTM Designation: D1784. Pipe dimensions and tolerances shall conform to the requirements of ASTM Designation: D2122. All joints shall be bell and spigot with rubber gaskets type. Pipe fittings shall conform to ANSI/AWWA C907. Thrust restraints shall conform to the requirements of ANSI/AWWA C907 to restrain thrust forces in accordance with AWWA Manual M23.

Backflow Preventer Assemblies:

Domestic backflow preventer shall be factory assembled with 2 check valves, one pressure differential relief valve, 2 ball valves and 4 test cocks. Domestic backflow preventer assemblies shall be of the approved type reduced pressure principle devices listed by the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section, 2525 Corporate Place, Monterey Park, California 91754, Telephone (213) 881-4140.

Fire service backflow preventer assemblies shall consist of welded steel pipe riser with ductile iron fittings, double check valves, outside screw and yoke (OS & Y) resilient seat gate valves, tamper switch unit, electrical conduit and conductors

Steel pipe shall meet the requirements of AWWA C200. Ductile iron flanged fittings shall shall meet the requirements of AWWA C115. Pipe and fittings shall be cement mortar lined and coated in accordance with AWWA C205.

Above-ground Backflow Preventer Pipe Support:

Backflow preventer pipe support shall be adjustable pipe saddle, Grinnel #264; or equal. Anchor bolts shall be stainless steel. Size and number shall match flange as recommended by the pipe support manufacturer.

Post Indicator Valve:

Post indicator valve with breakable padlock and tamper resistant switch for fire service shall be furnished and installed in accordance with these special provisions and the Rancho Cucamonga Fire District (RCFD) regulations.

Tamper Resistant Switch:

Tamper resistant switch for backflow preventer assemblies shall be of the type suitable for OS & Y valve installation, UL and CSFM listed, with NEMA 4 enclosure, Model OSYSU-1, Stock No. 1010106 as manufactured by Potter Electric Signal Co.; or equal.

Tamper resistant switch for post indicator valves shall be weather proof, UL, ULC and CSFM listed, with NEMA 4 enclosure, Model PCVS-1, Stock No. 1010107 as manufactured by Potter Electric Signal Co.; or equal.

Valves:

Gate Valve (3-inch and larger, below ground): Gate valve (3-inch and larger, below ground) shall be AWWA double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nuts, 200 psi working pressure, and Tee handle wrench for each valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Gate Valves (Fire Service Backflow, Fire Hydrant and Fire Alarm Post Indicator): Gate valves for fire service pipeline, fire hydrant assemblies, and fire alarm post indicator valves shall be resilient-wedge valves to be used for 4-inch through 12-inch, 250 psi working pressure. Cucamonga Valley Water District-approved valves are as follows: Kennedy (Ken-Seal 11) #4561, Mueller #A-2360, AFC Series 500, Clow #6102, AVK Series #25; or equal.

The valve for the fire alarm post indicator valve shall be wrapped with polyethylene sheeting 8 mil thick, minimum.

Valve Boxes:

Valve boxes shall be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER,". Extension shall be provided as required. Valve box shall be Christy, B3; Brooks Products Company, 3TL; Frazer, 3; or equal.

Fires Hyrdrants:

Fire hydrant shall conform to the requirements of AWWA Designation: C503. Fire hydrant shall have 6-inch inlet, and have one 4-inch outlet steamer hose and two 2½-inch outlets. Fire hydrant shall be Jones, Model J-3710R (8 Hole), Clow Model No 2050; or equal.

Fire Hyrdrant Pipe Bollards:

Fire hydrant pipe bollards shall be concrete-filled steel post on concrete foundation as shown on the plans. Steel post shall be schedule 40 steel pipe. Concrete foundation and pipe fill shall be minor concrete conforming to Section 90, "Portland Cement Concrete," of the Standard Specifications. Exposed surface of the pipe bollard shall be painted with Rustoleum #7644; or equal. Paint color shall be safety yellow.

Water Meters:

Water meters for the domestic water supply system will be furnished and installed by the serving utility at the locations shown on the plans.

The Contractor shall make the arrangements and pay the costs and fees required by the serving utility.

The Cucamonga Valley Water District has established a fee of $1,850 for furnishing and installing a 4-inch domestic water meter. If, at the time of installation, this fee has been changed, the State will take a credit for the reduction in the fee, or the State will pay the difference for the increase in the fee. The credit or payment will be taken or paid on the first monthly progress payment made after the meter is installed. The Contractor shall furnish the Engineer with a copy of the invoice for the installation fee.

Upon receipt of a written request from the Contractor, the Engineer will make arrangements with the serving utility to install the water meters. The State will pay the costs and fees charged by the serving utility for the installations.

Miscellaneous Metals:

Angle iron, steel supports and other miscellaneous metals required for the water supply system shall be in accordance with the provisions in Section 75, "Miscellaneous Metals," of the Standard Specifications.

Concrete Thrust Blocks

Concrete for thrust blocks shall be minor concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications.

Tracer Tape

Detectable tracer tape shall conform to the following:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
2. Foil Thickness: Minimum 0.35 mils.
3. Laminate Thickness: Minimum 5 mils.
4. Width: 3 inches.
5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
7. Manufacturers and Products: Reef Industries; Terra Tape, Sentry Line Detectable, Mutual Industries; Detectable Tape, Presco; Detectable Tape, or equal.
8. Color shall be blue in accordance with APWA Uniform Color Code for underground utilities.

Granular Pipe Bedding and Pipe Zone Backfill

Pipe bedding and pipe zone backfill material shall be unfrozen, friable, and no clay balls, roots or organic material selected from site excavation. Select site excavation material shall conform to the requirements in Section 19-3.025B, "Sand Backfill," of the Standard Specifications.

EXECUTION

Earthwork

Excavation, pipe bedding and pipe zone backfilling required for the installation of water supply system and appurtenances shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications.

Installation of Pipes And Fittings

Installation of pipes and fittings shall be in accordance with AWWA C605. Restrained joint system shall be in accordance with the manufacturer's written instructions.

The radius of curves on bending of pipe barrels for horizontal and vertical curves shall not exceed 75 percent of the manufacturer's recommended values.

Provide blocks and braces at pipe joints to ensure axial deflection in gasketed or mechanical joints does not exceed allowable deflection.

Water pipe shall not be installed below sewer pipe in the same trench or at any crossing, or below sewer pipe in parallel trenches less than 10 feet apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 12 inches between the top of the sewer and the bottom of the water pipe shall be maintained.

Thrust Blocks

Thrust blocks shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 2 inches and larger, and all capped connections.

Backflow Preventer

Backflow preventer assembly installation shall include backflow preventer, fittings, pipe, valves, pipe supports, and tamper resistant switches. Assembly components shall be the same size as the pipe in which they are installed unless otherwise shown on the plans.

Backflow preventer shall be installed a minimum of 18 inches above ground and shall be the same size as the pipe in which it is installed unless otherwise shown on the plans.

Chlorination

The Contractor shall flush, chlorinate, and disinfect all water piping system and fixtures in accordance with AWWA Standard C651.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water.

Installation of tamper resistant switch for fire service backflow preventer and post indicator valve shall be in accordance with the manufacturer's written installation instructions.

Tracer Tape Installation

Continuously install tracer tape along centerline of buried piping on top of the last lift of pipe zone backfill material.

FIELD QUALITY CONTROL

Testing Pipes and Fittings

The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

Tamper resistant switches for fire service backflow preventer and post indicator valves, including associated protective monitoring system shall be tested in accordance with applicable NFPA codes.

At the completion of the installation of the water supply piping the lines shall be made tight and shall be tested under a hydrostatic pressure of 125 psi. The pressure shall be maintained without fluctuation for a period of not less than 4 hours or longer if required by the Engineer.

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

The water supply system shall then be operated and checked by the Contractor for a period of at least 3 consecutive 8 hour-days to demonstrate the satisfactory overall operation of the water supply system as a completed unit. The test shall be conducted in the presence of the Engineer. During the test period, final adjustments shall be made to the equipment and components as required to place the system in satisfactory operating condition.

Any equipment, systems, or work found deficient during the test shall be replaced or repaired and retested. The Engineer shall be notified at least 72 hours in advance of starting the retest.

Testing Backflow Preventers

Backflow preventers installed by the Contractor shall be tested at the completion of the supply system installation for proper operation by a certified Backflow Preventer Tester.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to the provisions in the latest edition of the Guidance Manual For Cross Connection Control Program, which is available from the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 N 7th Street, P.O. Box 942732, Sacramento, CA 94234.

The Contractor shall notify the Engineer at least 5 days prior to testing backflow preventers. Such tests shall be satisfactorily completed after installation of the backflow preventer assemblies and before operation of the systems.

One copy of all test results for each backflow preventer shall be furnished to the Engineer.

Full compensation for providing the certified Backflow Preventer Tester and for testing the backflow preventers shall be considered as included in the lump sum price paid for building work and no additional compensation will be allowed therefor.

MEASUREMENT AND PAYMENT

Water supply and fire service piping will be measured and paid for by the linear foot.

The contract price paid per linear for water supply and fire service piping of the various sizes and types designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and

for doing all the work involved in water supply and fire service piping, complete in place, including equipment, pipe, fittings, tracer tape, line valves, testing, and chlorination, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Post indicator valve will be measured and paid for by the unit, determined from actual count in place.

The contract unit price paid for post indicator valve shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in post indicator valve, complete in place, including equipment, key valve, tamper resistant switch, conduit and wiring, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Backflow preventer will be measured and paid for by the unit of the actual units installed.

The contract unit price paid for the various sizes and types backflow preventers designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in backflow preventer, complete in place, including equipment, pipe, fittings, tamper resistant switch, and line valves, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Fire hydrant assembly will be measured and paid for by the unit determined, from actual count in place.

The contract unit price paid for fire hydrant assembly shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in fire hydrant assembly, complete in place, including equipment, pipe, fittings, line valves, and tracer tape, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for furnishing and applying paint required on above ground piping and backflow preventer assemblies shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be made therefor.

The quantity of water meters will be measured and paid for by the unit as 4" water meter (domestic water service), determined from actual count in place.

The contract unit price paid for 4" water meter (domestic water service) shall include full compensation for furnishing all labor, materials (including tracer tape), tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing 4" water meter (domestic water service), complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Fire hydrant pipe bollard will be measured and paid for by the unit as pipe bollard, determined from actual count in place.

The contract unit price paid for pipe bollard shall include full compensation for furnishing all labor, materials (including concrete fill and minor concrete), tools, equipment, and incidentals, and for doing all the work involved in pipe bollard, including painting, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-4.03 NATURAL GAS SUPPLY LINE SYSTEM

This work shall consist of furnishing, installing and constructing natural gas supply line system in accordance with the details shown on the plans and these special provisions.

Natural gas supply line system shall include other fittings and appurtenances, not mentioned, which are required for the complete installation and proper operation of the system.

SUBMITTALS

Product Data:

Materials list for materials to be used shall be submitted for approval and shall include the name of the manufacturer and the source, model number, description, and standard of manufacture.

Manufacturer's descriptive data and catalog cuts shall be submitted for the following:

1. Underground tracer tape
2. Gas pipe and fittings

QUALITY ASSURANCE

Codes and Standards: All gas piping work shall conform to the applicable portions of the California Plumbing Code (CPC), the International Association of Plumbing and Mechanical Officals (IAPMO), and Southern California Gas Co. requirements.

The Contractor's pipe installation personnel shall have successfully completed within the last 5 years installations similar in type and size to that of this project. In addition, the Contractor shall submit a copy of certificate to the Engineer indicating completion of an Operations Training from Southern California Gas Co. to safely execute techniques for the installation of underground natural gas pipeline facilities before performing work on the gas line system,

MATERIALS

Identification:

Underground Tracer Tape: Underground tracer tape shall be permanent, detectable, bright colored, continuous printed plastic tape intended for direct burial service; not less than 2 inches wide; lettering shall read "CAUTION GAS LINE BURIED BELOW".

Pipes And Fittings:

Pipes and Fittings: Gas pipe and fittings shall be medium-density polyethylene natural gas pipe, Class 315, conforming to ASTM Designation: D 2513. Pipe and fittings shall be extruded or molded from polyethylene resin which conforms to ASTM Designation: D 1248, Type II, Class B with antioxidants Category 5, Grade P23. Fittings shall conform to ASTM Designation: D 3261. Pipe shall be iron pipe size (IPS) with a Standard Dimension Ration (SDR) of 11.5 based on a long-term strength Hydrostatic Design Basis (HDB) of 1,250 psi in accordance with ASTM Designation: D 2837. The maximum allowable operating pressure (MAOP) shall be 60 psig for temperatures of 100 degrees F or less. Pipe shall be marked in accordance with ASTM Designation: D 2513.

Granular Pipe Bedding and Pipe Zone Backfill

Pipe bedding and pipe zone backfill material shall be unfrozen, friable, and no clay balls, roots or organic material selected from site excavation. Select site excavation material shall conform to the requirements in Section 19-3.025B, "Sand Backfill," of the Standard Specifications.

EXECUTION

Excavation, pipe bedding and pipe zone backfilling required for the installation of natural gas line and appurtenances shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications. Continuous underground tracer tape shall be installed directly above buried lines and 6 inches to 12 inches below finished grade during backfilling operations.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with an 8-inch minimum dirt leg.

Plastic pipe used for natural gas shall be below grade outside of building only. Transition to Class B2 plastic coated shall be before meter, regulator, or building wall with approved metal to plastic transition fitting. Polyethylene natural gas pipe shall be installed in accordance with International Association of Plumbing and Mechanical Officials (IAPMO) Standard: IS12-2006.

Testing:

All piping shall be tested in the presence of the Engineer after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test gas supply system by air pressure testing to 50 psig for a period of not less than 4 hours.

MEASUREMENT AND PAYMENT

The quantity of natural gas supply line system will be measured and paid for by the linear foot, determined from slope measurement designated by the Engineer.

The contract price paid per linear foot for natural gas supply line system shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in natural gas supply line system, complete in place, including earthwork, pipe, fittings and testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

10-4.04 SANITARY SEWAGE AND BUILDING DRAIN DISPOSAL SYSTEM

This work shall consist of furnishing, installing and constructing a sanitary sewage and building drain system in accordance with the details shown on the plans and these special provisions.

Sanitary sewage and building drain system shall include other fittings and appurtenances, not mentioned, which are required for the complete installation and proper operation of the system.

SUBMITTALS

Product Data:

Materials list for materials to be used shall be submitted for approval and shall include the name of the manufacturer and the source, model number, description, and standard of manufacture.

Manufacturer's descriptive data and catalog cuts shall be submitted for the following:

1. Underground tracer tape
2. Sewer pipe and fittings
3. Sewer pipe adapters
4. Drain pipe and fittings
5. Manhole
6. Manhole frame and cover
7. Coatings
8. Cleanouts

QUALITY ASSURANCE

Codes and Standards: All sanitary sewage and building drain work shall conform to the applicable portions of the California Plumbing Code (CPC).

Certificates of Compliance: Certificates of compliance shall be furnished for manhole covers and frames in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

MATERIALS

Identification:

Underground Tracer Tape: Underground tracer tape shall be permanent, detectable, bright colored green, continuous printed plastic tape intended for direct burial service; not less than 2 inches wide; lettering shall read "CAUTION SEWER BURIED BELOW".

Pipes And Fittings:

The Contractor shall install pipes and fittings from the following materials, of the weight and class with the joining method as indicated.

Building Drain Pipe and Pipe Adapters: Building drain pipe and fittings shall be polyvinyl chloride (PVC) gravity sewer plastic pipe and fittings conforming to ASTM Designation: D 3034, Standard Dimension Ratio (SDR) 35, with integral bell and bell and spigot rubber gasketed joints or conforming to ASTM Designation: D2665 with solvent welded fittings. Rubber gaskets shall conform to ASTM Designation: F 477. Stainless steel clamps with rubber boots shall not be used.

Building drain pipe adapters for PVC to clay piping shall be appropriately sized PVC flexible coupling manufactured for connecting dissimilar pipes. Adapters shall be attached to piping with adjustable stainless steel band clamps with hex tightening screws. Rubber boots will not be allowed. Building drain pipe adapter shall be Indiana Seal; Fernco; or equal.

Sanitary Sewer Pipe: Sanitary sewer pipe and fittings shall be vitrified clay pipe (VCP) gravity sanitary sewer and fittings conforming to ASTM Designation: C 700, extra strength, with integral bell and bell and spigot joints, compression type gasketed joints conforming to ASTM Designation: C425. Lubricants for joining pipe shall be of the type approved by the pipe manufacturer.

Sewer Manholes

Manhole and distribution box riser sections and cones shall be precast, reinforced concrete, conforming to ASTM Designation: C 478, or precast reinforced concrete pipe conforming to ASTM Designation: C 76.

Manhole frame and cover shall be gray cast iron, Alhambra Foundry Co. Ltd., No. A-1170.

Sewer manhole steps shall be 3/4-inch diameter galvanized iron or steel reinforced copolymer polypropylene plastic steps Type PS2-PF, as manufactured by MA Industries, or approved equal.

Cleanouts

Sanitary sewer cleanouts piping and cleanout boxes shall conform to the requirements shown on the plans.

Manhole Coatings

Bituminous coating for interior and exterior surfaces of sewer manholes shall conform to ASTM Designations: D 41and D 449.

Granular Pipe Bedding and Pipe Zone Backfill

Pipe bedding and pipe zone backfill material shall be unfrozen, friable, and no clay balls, roots or organic material selected from site excavation. Select site excavation material shall conform to the requirements in Section 19-3.025B, "Sand Backfill," of the Standard Specifications.

Miscellaneous Materials

Cement Mortar: Cement mortar shall be one part cement to 2 to 3 parts clean plaster or concrete sand mixed with just enough water for suitable consistency.

Epoxy Mortar: Epoxy mortar shall be a commercial quality, trowelable, 3-component epoxy mortar consisting of 2 pourable epoxy components and a chemically resistant aggregate filler of silica quartz sand with a maximum water absorption of 0.1 percent. Epoxy shall have a pull-off strength of not less than 1,000 psi and a 90 percent cure in 24 hours. Epoxy mortar shall be the type that requires no primer as a bonding agent.

Miscellaneous Concrete: Miscellaneous concrete used in sanitary sewer and building drain disposal system shall be minor concrete conforming to the provisions in Section 90, "Portland Cement Concrete," of the Standard Specifications.

EXECUTION

Excavation and Backfill

Excavation and backfill shall conform to the provisions in Section 19-3, "Structure Excavation and Backfill," of the Standard Specifications and these special provisions.

The pipe shall be laid in a trench excavated to the lines and grades designated by the Engineer. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel.

Suitable excavation shall be made to receive the bell of the pipe and joint shall not bear upon the bottom of the trench. All adjustment to line and grade shall be made by scraping away or filling in with sand, gravel or granular material under the body of the pipe, and not by wedging or blocking.

Installation of Identification

Continuous underground tracer tape shall be installed directly above buried lines and 6 inches to 12 inches below finished grade during backfilling operations.

Installation of Pipes And Fittings

Sewer and building drain pipe shall be installed upgrade (starting from utility connection back to the construction) unless otherwise permitted by the Engineer.

Sewer pipes near water lines shall be installed below water lines in the same trench, in parallel trenches less than 10 feet apart, or at any crossing.

When water lines cross above a sewer line, a vertical separation of not less than 12 inches shall be maintained between the top of the sewer pipe and the bottom of the water line.

Joint connections between differing pipe types shall be made with sewer pipe adapters intended for that purpose.

Damaged pipe shall be replaced prior to use. Misaligned pipe shall be corrected or replaced prior to use.

Interior of pipes shall be cleaned of dirt and other materials as the work progresses.

Lines between manholes shall be flushed as necessary to remove collected material.

Installation of Manholes

Manholes shall be installed in accordance with the details shown on the plans.

All joints and penetrations of manholes shall be sealed watertight, inside and outside, with epoxy mortar.

A concrete collar shall be formed and cast in place around each manhole in accordance with the details shown on the plans.

Where new manholes are to be installed to grade in areas to be paved or surfaced, no individual structure shall be constructed to final grade until the paving or surfacing has been completed in the immediate area.

Installation of Cleanouts

Cleanouts shall be installed 90 degrees to finished grade and shall terminate in a valve box. A concrete pad shall be provided full width of the trench under a wye branch

Cleanouts to grade shall be a combination of fittings as shown on the plans. Piping and fittings for 4-inch pipe shall be sewer pipe. Piping and fittings for 3-inch pipe and smaller shall be drain pipe.

Collars shall be broom surface finished. Collars shall match existing/finished grade. Compaction prior to form work shall be as specified elsewhere in these special provisions.

Application of Coatings

The interior and exterior surfaces of concrete sewer structures shall be completely coated with 2 applications of bituminous coating, applied at a rate of 100 square feet per gallon.

Concrete surfaces to be coated shall not be coated until 28 days after the last concrete for these structures has been poured.

The edge and bottom of manhole cover seat areas shall be coated with a uniform application of heavy duty, waterproof automotive or industrial grease.

FIELD QUALITY CONTROL

Testing Pipes

All sanitary sewer and building drain pipes shall be tested for obstructions before covering the pipes by balling and flushing the pipes with an approved commercial sewer cleaning ball. The ball shall be moved slowly through the sewer with a tag line. Four-inch sewer pipe shall be tested by pulling an appropriate sized inflatable plug through the pipe. Obstructions or irregularities shall be removed or repaired.

Sanitary sewer and building drain pipes shall be tested for leakage for a minimum period of 4 hours by filling with water to an elevation of 4 feet above the average invert of sewer pipe, or to the top of the manholes where less than 4 feet deep. The system shall show no visible leaks, and the leakage rate shall not exceed the rate allowed by the local agency. In the absence of such requirements, leakage shall not exceed one pint per 24 hours, per millimeter diameter, per 100 feet of pipe. Sewer pipes may be tested in sections with the test water progressively passed down the sewers if feasible. Water shall be released at a rate which will not create water hammer or surge in the plugged section of sewer.

In lieu of hydrostatic test with water, the air test method, "Air Test," as outlined in the CPC, may be used.

MEASUREMENT AND PAYMENT

The contract price paid per linear for 6" vitrified clay pipe shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in 6" vitrified clay pipe, complete in place, including pipe, fittings and testing, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Sanitary sewer cleanout will be measured and paid for by the unit of the actual units installed in place.

The contract unit price paid for sanitary sewer cleanout shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved sanitary sewer cleanout, complete in place, including pipe, fittings, and cleanout box, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Sanitary sewer manhole will be measured and paid for by the unit of the actual units installed in place.

The contract unit price paid for sanitary sewer manhole shall include full compensation for furnishing all labor, materials (including frame and cover), tools, equipment, and incidentals, and for doing all the work involved sanitary sewer manhole, complete in place, including manhole structure coating, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for building drain pipe and building cleanout shall be considered as included in the contract lump sum price paid for building work and no separate payment will be made therefore.

SECTION 11. (BLANK)

SECTION 12. BUILDING WORK

SECTION 12-1. GENERAL REQUIREMENTS

12-1.01 SCOPE

SUMMARY

Scope.--Building work shall conform to the requirements of these special provisions and Sections 1 through 9 of the Standard Specifications. Sections 10 through 95 of the Standard Specifications shall not apply to the work in Section 12 except when specific reference is made thereto.

The building work to be done consists, in general, of constructing a new regional materials testing lab facility. The site is adjacent to Interstate 15 in San Bernardino County. The building work consists of the following:

1. General: Construct a group of single story laboratory and office buildings on a site previously prepared by an earlier civil contract which included rough grading, street improvements and utilities hook-ups.
2. Building concrete foundations and concrete slab work, including requisite earthwork.
3. Building System (General): Masonry walls with single ply roofing over a metal deck on open web joists
4. Architectural finishes.
5. Special laboratory casework and equipment.
6. Plumbing and electrical, including fixtures and specialties.
7. Heating, ventilation and cooling.

12-1.02 ABBREVIATIONS

Section 1-1.02, "Abbreviations," of the Standard Specifications is amended by adding the following:

AAMA	American Architectural Manufacturers' Association
ACI	American Concrete Institute
ACGIH	American Conference of Industrial Hygienists
AGA	American Gas Association
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
APA	American Plywood Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
BHMA	Builder’s Hardware Manufacturing Association
CBC	California Building Code (2001 Edition)
CEC	California Electrical Code (2001 Edition)
CMC	California Mechanical Code (2001 Edition)
CPC	California Plumbing Code (2001 Edition)
CS	Commercial Standards (US Department of Commerce)
DOC PS	Department of Commerce Voluntary Product Standard
DHI	Door and Hardware Institute
ESO	Electrical Safety Orders
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
FS	Federal Specification
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
ISO	International Organization for Standardization
ISTA	International Safe Transit Association

MH	Material Handling (now MHIA)
NBFU	National Board Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association or National Forests Products Association
PEI	Porcelain Enamel Institute
PS	Product Standard (US Department of Commerce)
RIS	Redwood Inspection Service
SCPI	Structural Clay Products Institute
SEFA	Scientific Equipment and Furniture Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SDI	Steel Door Institute
SSPC	Steel Structures Paint Council
TCA	Tile Council of America
TPI	Truss Plate Institute
UBC	Uniform Building Code (1997 Edition)
WCLIB	West Coast Lumber Inspection Bureau (stamped WCLB)
WCLB	Grade stamp for WCLIB
WIC	Woodwork Institute of California
WWPA	Western Wood Products' Association

12-1.03 GUARANTEE

The Contractor hereby unconditionally guarantees that the building work will be done in accordance with the requirements of the contract, and further guarantees the building work of the contract to be and remain free of defects in workmanship and materials for a period of one year from the date of acceptance of the contract, unless a longer guarantee period is required elsewhere in these special provisions. The Contractor hereby agrees to repair or replace any and all building work, together with any other adjacent work which may be displaced in so doing, that may prove to be not in accordance with the requirements of the contract or that may be defective in its workmanship or material within the guarantee period specified, without any expense whatsoever to the Department, ordinary wear and tear and unusual abuse or neglect excepted.

The performance bond for contract price of the building work shall remain in full force and effect during the guarantee period.

The Contractor further agrees, that within 10 calendar days after being notified in writing by the Department of any building work not in accordance with the requirements of the contract or any defects in the building work, he shall commence and prosecute with due diligence all work necessary to fulfill the terms of this guarantee, and shall complete the work within a reasonable period of time, and, in the event he fails to comply, he does hereby authorize the Department to proceed to have such work done at the Contractor's expense and he shall honor and pay the cost and charges therefor upon demand. The Department shall be entitled to all costs and expenses, including reasonable attorney's fees, necessarily incurred upon the Contractor's refusal to honor and pay the above costs and charges.

12-1.04 AREAS FOR CONTRACTOR'S USE

No area is available within the contract limits for the exclusive use of the Contractor. The Contractor shall arrange with the Engineer for areas to store equipment and materials within the work area.

12-1.05 COOPERATION

Attention is directed to Sections 7-1.14, "Cooperation," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications. and these special provisions.

WORK UNDER OTHER CONTRACTS

Preceding Work: The Department has awarded a separate contractfor the following construction operations at the project site. Those operations are scheduled to be substantially complete before work under this Contract begins: TMC/SRL (EA 08-3770U) will be awarded to prepare the site for this Southeran Regional Laboratory and a future Transportation Management Center. Contract includes rough grading, street improvements, site drainage, underground utilities, and the construction of a Park and Ride facility.

Future Work: The Department will award a separate contract for the following additional work to be performed at site after Final Completion. Completion of that work will depend on successful completion of preparatory work under this Contract: TMC (EA 08-37704) will be awarded to construct a Transportation Management Center adjacent to the work site.

The Contractor shall comply with all security policies and normal working hours of the State concerning the Southern Regional Lab.

The Contractor shall plan his work to minimize interference with State forces and the public. Interruptions to any services for the purpose of making or breaking a connection shall be made only after consultation with and for such time periods as directed by the Engineer.

12-1.06 SUBMITTALS

Working drawings, material lists, descriptive data, samples and other submittals specified in these special provisions shall be submitted for approval in accordance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions.

Schedule of Submittals: Within 20 days after the contract has been approved, the Contractor shall submit a completed submittal schedule and list of products for all items requiring the Engineer's review and approval, as follows:

1. Submittals, including description of the item and name of manufacturer, trade name and model number.

2. Specification reference.

3. Intended submission.

4. Lead time to delivery/anticipated delivery date(s).

5. These schedules shall be presented in a form acceptable to the Engineer in both electronic and hard copy versions and shall be updated and sent to the Engineer on a monthly basis. Identify all submittals that are required by the contract documents and determine the date on which each submittal will be submitted in conformance with the schedules specified under "Progress Schedule (Critical Path Method)" of these special provisions.

Unless otherwise permitted in writing by the Engineer, all submittals required by these special provisions shall be submitted within 35 days after the contract has been approved.

Attention is directed to the provisions in Section 5-1.01, "Authority of Engineer," of the Standard Specifications. The Engineer may request submittals for materials or products where submittals have not been specified in these special provisions, or may request that additional information be included in specified submittals, as necessary to determine the quality or acceptability of such materials or products.

Attention is directed to Section 6-1.05, "Trade Names and Alternatives," of the Standard Specifications. The second indented paragraph of the first paragraph of said Section 6-1.05 is amended to read:

Whenever the specifications permit the substitution of a similar or equivalent material or article, no test or action relating to the approval of such substituted material will be made until the request for substitution is made in writing by the Contractor accompanied by complete data as to the equality of the material or article proposed. Such request shall be made within 35 days after the date the contract has been approved and in ample time to permit approval without delaying the work, but need not be made in less than 35 days after award of the contract.

Work requiring the submittal of working drawings, material lists, descriptive data, samples, or other submittals shall not begin prior to approval of said submittal by the Engineer. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.
Submittals shall be delivered to the locations indicated in these special provisions. If a specific location is not indicated, the submittal shall be delivered to the Division of Structure Design, Documents Unit, Fourth Floor, Mail Station 9-4/4I,

1801 30th Street, Sacramento, California 95816, telephone (916) 227-8252, or the submittals shall be mailed to the Division of Structure Design, Documents Unit, Mail Station 9-4/4I, P. O. Box 942874, Sacramento, California 94274-0001.

Each submission of drawings, material lists and descriptive data shall consist of at least 5 copies. Two copies will be returned to the Contractor either approved for use or returned for correction and resubmittal.

Each separate item submitted shall bear a descriptive title, the name of the project, district, county, and contract number. Plans and detailed drawings shall be not larger than 22" x 36".

The material list shall be complete as to name of manufacturer, catalog number, size, capacity, finish, all pertinent ratings, and identification symbols used on the plans and in the special provisions for each unit.

Parts lists and service instructions packaged with or accompanying the equipment installed in the work shall be delivered to the Engineer at the jobsite. Required operating and maintenance instructions shall be submitted in triplicate.

Manufacturer's warranties for products installed in the work shall be delivered to the Engineer at the jobsite.

Unapproved samples and samples not incorporated in the work shall be removed from State property, when directed by the Engineer.

12-1.07 PROGRESS SCHEDULE

A progress schedule shall be submitted in duplicate for the building work in accordance with the requirements in "Progress Schedule (Critical Path Method)" of these special provisions.

12-1.08 SCHEDULE OF VALUES

The Contractor shall prepare and submit to the Engineer for approval 2 copies of a Schedule of Values within 15 working days of approval of the contract covering each lump sum item for building work. Fifteen working days shall be allowed for approval or return for correction of each submittal or resubmittal. Should the Engineer fail to complete his review within the time specified and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of the delay in review, an extension of time commensurate with the delay in completion of the work thus caused will be granted as provided in Section 8-1.07, "Liquidated Damages," of the Standard Specifications.

The Schedule of Values must be accurately divided into sections representing the cost of each separate building or structure. All work that is not part of a separate building or structure, such as excavation, grading, curbs, gutters, sidewalks, paving, sewer and storm drainage and utility distribution lines are to be included under a specific section as General Work and not included in the building or structure cost. Indirect costs and general condition items are to be listed as a separate line item of work. The sections representing each building or structure must be identified as to the building or structure they represent and be broken down to show the corresponding value of each craft, trade or other significant portion of the work. A sub-total for each section shall be provided.

The Schedule of Values shall be approved by the Engineer before any partial payment estimate is prepared.

The sum of the items listed in the Schedule of Values shall equal the contract lump sum price for building work. Overhead, profit and bond premium are to be proportionally distributed across all line items of cost.

12-1.10 REGULATORY REQUIREMENTS

Materials shall conform to the rules for control of Volatile Organic Compound (VOC) emissions adopted by the air quality control district in the air basin in which the materials are to be applied.

12-1.11 INSPECTION

All items covered or all stages of work that are not to remain observable must be inspected and approved before progress of work conceals portions to be inspected. The Contractor shall notify the Engineer not less than 72 hours in advance of when such inspection is needed.

12-1.11 PRESERVATION OF PROPERTY

Attention is directed to Sections 7-1.11, "Preservation of Property," 7-1.12, "Responsibility for Damage," 7-1.16, "Contractor's Responsibility for the Work and Materials," and 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications.

Operations shall be conducted in such a manner that existing facilities, surfacing, installations, and utilities that are to remain in place will not be damaged. Temporary surfacing, facilities, utilities and installations shall also be protected until they are no longer required. The Contractor, at his expense shall furnish and install piling, sheet piling, cribbing, bulkheads, shores, or whatever means may be necessary to adequately support material carrying such facilities, or to support the facilities themselves and shall maintain such support until they are no longer needed.

12-1.12 UTILITY CONNECTION

The Contractor shall make all arrangements, and obtain all permits and licenses required for the extension of and connection to each utility service applicable to this project, shall furnish all labor and materials necessary for such extensions which are not performed or provided by the utility, and shall furnish and install any intermediate equipment required by the serving utilities.

Upon written request by the Contractor, the State will pay all utility permits, licenses, connection charges, and excess length charges directly to the utility. Such request shall be submitted not less than 45 days before service connections are required.

The costs incurred by the Contractor for the extensions of utilities beyond the limits shown on the plans, and in furnishing and installing any intermediate equipment required by the serving utilities, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.
Full compensation for any costs incurred by the Contractor to obtain the permits and licenses shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefore.

12-1.13 TEMPORARY UTILITIES

The Contractor may obtain electrical power and water from existing State electrical power and water outlets within the contract limits free of charge for contract operations where such utilities exist, provided that such utility services are in service and are not required by the State for other purposes and subject to the provisions in the section "Cooperation" of these special provisions.

The Contractor shall make his own arrangements to obtain any additional electrical power and water or other utilities required for his operations and shall make and maintain the necessary service connections at his own expense.

When existing utility systems are being modified, the Engineer will determine periods of shutdown.

The Contractor shall provide adequate temporary lighting to perform the work and allow the Engineer to inspect the project as each portion is completed.

The Contractor shall provide and pay for telephone service he may require. State telephone facilities shall not be used.

12-1.14 SANITARY FACILITIES

State sanitary facilities will not be available for use by the Contractor's employees, during normal State working hours. Tools shall not be cleaned nor shall cleaning liquids be disposed of in State sanitary facilities or sewers.

Separate toilet facilities shall be provided for Contractor's personnel. Facilities shall include the periodic flushing, waste removal and cleaning of such facilities. Units shall to be maintained in a clean and sanitary condition, including a supply of toilet tissue, toilet seat covers, paper towels and paper cups. Waste material shall be disposed of off site in a lawful manner. Temporary toilet units shall be single occupant units of the chemical type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

12-1.15 MEASUREMENT AND PAYMENT

The contract lump sum price paid for building work shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the building work, complete in

place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for any incidental materials and labor, not shown on the plans or specified, which are necessary to complete the buildings and appurtenances shall be considered as included in the contract lump sum price paid for building work and no additional compensation will be allowed therefore.

12-1.16 PROJECT RECORD DRAWINGS

The Contractor shall prepare and maintain one set of project record drawings, using an unaltered set of original project plans, to clearly show all as-constructed information for the project. As a minimum, the information to be shown shall include 1) any plan clarifications or change orders, 2) locations of any underground utilities, or 3) the location, size, type, and manufacturer of all major products or components selected by the Contractor for use in the work.

All markings shall be placed on the project record drawings using red ink or red pencil. Original figures shall not be eradicated nor written over and superseded material shall be neatly lined out. Additional drawings shall be submitted if the required information cannot be clearly shown on the original set of project plans. The additional drawings shall be not less than 11" x 17" in size and shall have the contract number on each sheet. The Contractor shall sign and date each sheet of the project record drawings to verify that all as-constructed information shown on the drawings is correct.

The Contractor shall periodically review the set of project record drawings with the Engineer during the progress of the work to assure that all changes and other required information are being recorded.

Before completion of the work, the Contractor shall request a review of the project record drawings to determine the completeness and adequacy of them. If the project record drawings are unacceptable, the Contractor shall inspect, measure, and survey the project as necessary to record the required additional information.

The set of completed project record drawings shall be delivered to the Engineer prior to acceptance of the contract.

12-1.17 FIELD ENGINEERING

This section specifies administrative and procedural requirements for field engineering services to be performed by the Contractor.

Lines and Grades:

Attention is directed to Section 5-1.07 “Lines and Grades,” of the Standard Specifications.

Such stakes or marks will be set by the Engineer as he determines to be necessary to establish the lines and grades required for the completion of the work shown on the plans and as specified in these special provisions. In general, these will consist of the primary vertical and horizontal control points.

Stakes and marks set by the Engineer shall be carefully preserved by the Contractor. In case such stakes and marks are destroyed or damaged they will be replaced at the Engineer’s earliest convenience. The Contractor will be charged for the cost of necessary replacement or restoration of such stakes and marks which in the judgment of the Engineer were carelessly or willfully destroyed or damaged by the Contractor’s operations. This charge will be deducted from any moneys due or to become due the Contractor.

All other stakes or marks required to establish the lines and grades required for the completion of the work shall be the responsibility of the Contractor.

Existing utilities and equipment:

The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, the Contractor shall investigate and verify the existence and location of underground utilities and other construction.

Prior to construction, the Contractor shall verify the location and invert elevation at points of connection of sanitary and septic sewers, storm sewer, and water or fire service piping.

Surveys for layout and performance:

The Contractor shall perform all surveys for layout and performance, reduce field notes, and make all necessary calculations and drawings necessary to carry out the work.

The Contractor shall locate and layout site improvements, and other work requiring field engineering services, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

Batter boards shall be located and laid out for structures, building foundations, column grids and locations, floor levels and, control lines and levels required for mechanical and electrical work.

Survey accuracy and tolerances:

The tolerances generally applicable in setting survey stakes for foundations, slabs, and underground work shall not exceed the following:

Survey Stakes or Markers	Tolerance
Rough grading or excavation	0.10-foot
Trimming or preparation of subgrade for roadways	0.05-foot
Roadway surfacing, steel or concrete pipe	0.02-foot
Structures or building construction	0.01-foot

Such tolerance shall not supersede stricter tolerances required by the plans or special provisions, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therein.

SECTION 12-2. SITEWORK

12-2.01 EARTHWORK FOR BUILDING WORK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of performing earthwork for building work in accordance with the details shown on the plans and these special provisions.

Section Includes: Earthwork for building work shall consist of structure excavation and structure backfill. Structure excavation shall include excavation for footings, foundations, walls, slabs, tanks, drywells, manholes, oil/water separators, clarifiers, and trenches. Structure backfill shall include backfilling under slabs; backfilling under and around footings; backfilling for walls, backfilling for pipes and conduits; backfilling holes resulting from removal of existing facilities. In addition to structure excavation and structure backfill, earthwork for building work shall include any other earthwork, not mentioned, but necessary to complete the building work.

Attention is directed to the "Project Information" of these special provisions for information regarding foundation report that was prepared for use during the design of this project.
Attention is directed to the requirements of "Field Engineering" in Section 12-1, “General Requirements,” of these special provisions.

QUALITY ASSURANCE

Samples: Samples of sand, pea gravel, or crushed stone, weighing not less than 25 pounds, shall be submitted to the Engineer at the jobsite for approval.

SITE CONDITIONS

Existing Underground Piping and Conduit: The location of existing underground piping and conduit is based on the best records available. Before beginning work, the Contractor shall accurately locate the piping and conduit involved in the work. If the location of the existing piping or conduit deviates from the location shown on the plans by more than 5 feet, or, if no elevations are indicated and the piping or conduit is more than 3 feet below grade, the cost of the additional excavation, backfill, piping or conduit, and removal and replacement of concrete, if any, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Existing Surfaced or Planted Areas:

Existing surfaced or planted areas that are removed, broken or damaged by the Contractor's operations shall be restored to their original condition except as otherwise shown on the plans or specified herein.

Restoration materials shall be equal to or better than the original materials. Surfacing shall be replaced to match the material thickness, grades, and finish of the adjacent surrounding surfaces.

PART 2 - PRODUCTS

BACKFILL MATERIALS

Structure Backfill: Structure and trench backfill shall be free of organic and other deleterious material and shall be suitable for the required compaction. Gravel without sand matrix shall not be used except as free draining granular material beneath slabs and footings.

Select Backfill: Select backfill shall conform to the requirements specified under "Aggregate Base," elsewhere in this Section 12-2.

Sand: Sand shall be clean, washed sand, free from clay or organic material graded such that 100 percent passes the 1/4-inch sieve, 90 percent to 100 percent passes the No. 4 sieve and not more than 5 percent passes the No. 200 sieve size.

Pea Gravel (Naturally Rounded):

Pea gravel (naturally rounded) shall be clean, washed, dry density of not less than 95 pounds per cubic foot, free from clay or organic material and shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
3/4"	100
1/2"	90-100
3/8"	40-70
No. 4	0-15
No. 8	0-3

Pea gravel shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

Crushed Stone:

Crushed stone shall be clean, washed, dry density of not less than 95 pounds per cubic foot, crushed stone or crushed gravel with an angular particle size not less than 1/8 inch or more than 1/2 inch.

Sieve or Screen Size	Percentage Passing
1/2"	100
3/8"	85-100
No. 4	10-30
No. 8	0-3

Crushed stone shall conform to the following requirements:

Test	California Test No.	Test Requirements
Durability Index	229	35 Min.

PART 3 - EXECUTION

PREPARATION AND RESTORATION

Sawcutting: Prior to excavation or trenching, existing surfacing shall be removed to saw cut lines, or to existing wood dividers or expansion joints, if any. The saw cut shall be to a neat line and have a depth not less than one inch.

Restoration: Surfacing shall be replaced to match the thickness, grades and finish of the adjacent surrounding surfaces.

STRUCTURE EXCAVATION

Unless otherwise noted, all excavation for building work shall be classified as structure excavation.

Footing Excavation:

The bottom of excavation shall not be disturbed, unless noted otherwise. The contractor shall excavate by hand to the final grade. The bottom of concrete footings shall be poured against undisturbed material. Unless otherwise noted, compaction of the bottom of footing excavation is not required unless the material is disturbed. The footing depths shown on the plans shall be changed to suit field conditions when directed by the Engineer. Solid rock at or near required depths shall not be disturbed. Unsuitable material shall be excavated down to firm bearing as directed by the Engineer. Work and materials required because of excavation in excess of the depths shown on the plans, when such excavation has been ordered by the Engineer, will be paid for as extra work as provided in Section 4-1.03D of the Standard Specifications.

Excavate to the elevations and dimensions within a tolerance of ±1/2 inch. Limits of the excavation shall allow for adequate working space for installing materials and as required for safety of personnel. Such working space excavation shall be replaced in kind and compacted at the Contractor's expense.

Overdepth excavation for footings shall be backfilled with concrete or such other material recommended by the Contractor and approved by the Engineer. Relative compaction shall be not less than 95 percent.

At locations and to the limits shown on the plans, material below the bottom of the foundation or footing shall be removed and replaced with select backfill in accordance with the placing and compacting requirements for backfill.

Sub-excavation and re-compaction with the native material at the building sites for both the Main Laboratory Building and Independent Assurance Building is required. The sub-excavation shall be to the depth and extension shown on the plans. The sub-excavation area shall be backfilled with native material and compacted to 95% relative compaction.

Excavation for Pipes and Conduits:

Pipes or conduits in the same trench shall have a minimum clear distance between pipes or conduits of 6 inches. Pipes or conduits shall have not less than 2½ feet of cover from top of pipes or conduits to finished grade unless otherwise shown on the plans or specified.

Trenching shall be of sufficient depth to permit placing a minimum depth of 4 inches of compacted sand under all pipes and conduits.

Excavation adjacent to trees shall be performed by hand methods where necessary to avoid injury to trees and roots. Roots 2 inches in diameter and larger shall be protected with heavy burlap. Roots smaller than 2 inches in diameter adjacent to trees shall be hand trimmed. Cuts through roots 1/2 inch in diameter and larger shall be sealed with tree trimmers' asphaltic emulsion. If trenches remain open more than 24 hours, the side of the trench adjacent to the tree shall be shaded with burlap and kept damp. Materials shall not be stockpiled within the drip line of trees.

Dewatering: Excavations shall be kept clear of standing water. Water shall be removed by pumping if necessary. Water removed from excavation shall be carried away from the building site and disposed of in a manner that will not harm State or adjacent property.

STRUCTURE BACKFILLING

Unless otherwise noted, all backfill for building work shall be classified as structure backfill. Backfill shall be placed and compacted in horizontal layers, not more than 6 inches thick prior to compaction, and to the lines and grades shown on the plans or to original ground.

Structure Backfill: After structures are in place and forms are removed, wood and other debris shall be removed from excavations before placing structure backfill.

Select Backfill: At the locations and to the limits shown on the plans, materials below the bottom of footings or foundations shall be removed and replaced with select backfill material in accordance with the placing requirements of structure backfill.

Backfilling Pipes and Conduits:

Backfill placed under pipe and conduits shall be compacted sand, 4 inches minimum depth. Backfill material placed to a level 6 inches above tops of pipes and conduits shall be sand or fine earth and particles shall not exceed 1/2 inch in greatest dimension. For wrapped, coated, or plastic pipe or conduits, sand shall be used for backfill. Backfill material placed higher than 6 inches above tops of pipes or conduits shall consist of material free of stones or lumps exceeding 4 inches in greatest dimension except:

1. The top 12 inches of backfill under roads, walks or paving shall consist of aggregate base material.
2. The top 6 inches of backfill in planted areas shall consist of topsoil.

Unless otherwise shown on the plans, pipe under roads, with less than 2½ feet of cover over the top of pipe, shall be backfilled with concrete to a level 4 inches above the top of pipe. Concrete for backfill shall be commercial quality concrete containing not less than 564 pounds of cement per cubic yard.

COMPACTION

Relative compaction shall be determined in accordance with California Test 216 or 231.

Unless otherwise noted below, all backfill shall be compacted to a minimum relative compaction of 90 percent.

Unless approved in writing by the Engineer, compaction by jetting or ponding will not be permitted.

Compact Original Ground: Original ground surface under fill with surfacing of concrete and asphalt concrete shall be compacted to a relative compaction of not less than 95 percent for a minimum depth of 6 inches.

Subgrade Preparation:

Preparation of subgrade material for placing aggregate base, surfacing, or slabs thereon shall include fine grading, compaction, reworking as necessary. The upper 6 inches of the subgrade shall have the same compaction as the fill to be placed over it.

The prism of backfill directly underneath the building foundation and sloping downward at 1:1 shall be compacted to 95 percent.

Structure Backfill: Structure backfill shall be compacted to not less than 95 percent relative compaction.

Select Backfill:

Select backfill shall be compacted to not less than 95 percent relative compaction.

A relative compaction of not less than 95 percent shall be obtained for a minimum depth of 6 inches below the bottom of the excavation before placing select backfill.

Trench Backfill: Trench backfill placed beneath slabs or paved areas shall be compacted to a relative compaction of not less than 95 percent.

DISPOSAL

Surplus Material: Surplus material from the excavation shall be removed and disposed of outside the right-of-way in accordance with Section 7-1.13, "Disposal of Material Outside the Highway Right of Way" of the Standard Specifications.

FIELD QUALITY CONTROL

Inspection: When the excavation is substantially completed to grade, the Contractor shall notify the Engineer. No concrete shall be placed until the foundation has been approved by the Engineer.

Testing: The State will conduct compaction tests during the backfilling and compacting operations.

12-2.02 AGGREGATE BASE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing, spreading and compacting aggregate base in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS

Aggregate base:

Aggregate base shall be commercial quality aggregates consisting of broken stone; crushed gravel; natural, clean, rough-surfaced gravel and sand; or a combination thereof.

Aggregate base shall conform to the following grading as determined by California Test 202:

Sieve or Screen Size	Percentage Passing
1"	100
3/4"	90 - 100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2 - 9

Aggregate base shall also conform to the following quality requirements:

Tests	California Test No.	Test Requirements
Durability Index Resistance (R-Value)	229 301	35 Min. 78 Min.
Sand Equivalent	217	22 Min.

PART 3 - EXECUTION

SPREADING AND COMPACTING

Spreading:

Aggregate base shall be placed and compacted to the lines and grades shown on the plans.

Spreading and compacting shall be performed by methods that will produce a uniform base, free from pockets of coarse or fine material.

Compaction: Relative compaction of each layer of compacted base material shall be not less than 95 percent, as determined by California Test 216 or 231.

12-2.03 FREE DRAINING GRANULAR MATERIAL

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and placing free draining granular material beneath slabs in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS

Free Draining Granular Material: Free draining granular material shall be clean, hard, durable, free-draining rock. The material gradation shall be such that all passes the one-inch screen, and not more than 10 percent passes the No. 4 sieve as determined by California Test 202. Granular material shall be free from organic material, clay balls or other deleterious substances.

PART 3 - EXECUTION

SPREADING AND CONSOLIDATING

Free draining granular material shall be placed, spread, and consolidated by tamping or vibrating.

12-2.04 ACCESSIBLE PARKING AND AUTHORIZATION SIGNS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing accessible parking and authorization signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and sign fastening details shall be submitted for approval.

PART 2 - PRODUCTS

Accessible Parking Stall Identification Sign: Accessible parking stall identification sign shall be a reflective metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol, lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Van Accessible Sign: Van accessible sign shall be a reflective metal sign with baked enamel finish and the international symbol of accessibility. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Unauthorized Vehicles Parking Sign: Unauthorized vehicles parking sign shall be a reflective metal sign with baked enamel finish. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Lettering and border shall be white and shall conform to Federal Standard 595B, Color No. 17886. Lettering shall be not less than one-inch in height and shall read as shown on the plans.

Support Post: Support post shall be commercial quality, standard weight, galvanized steel pipe. Pipe diameter shall be 1¾ inch.

Fastening Hardware: Fastening hardware shall be galvanized or cadmium plated.

Concrete: Concrete for support posts shall be commercial quality concrete, proportioned to provide a workable mix suitable for the intended use, with not less than 470 pounds of cement per cubic yard.

PART 3 - EXECUTION

Installation:

Support posts shall be placed in holes excavated to the depth and cross-section shown on the plans. Posts shall be set vertical and shall be firmly embedded in concrete backfill. The top of the concrete backfill around the post shall be crowned to drain water.

Support posts shall be fitted with a rainproof top.

Sign shall be fastened rigidly and securely to the support post.

The Engineer will provide the Contractor with the necessary information for unauthorized vehicles/parking area sign. This information shall become a permanent part of the sign.

12-2.05 SITE FURNISHINGS

PART 1 GENERAL

SUMMARY

Scope: This work consists of the requirements to provide and install site furnishings as indicated on the plans and in the Special Provisions.

SUBMITTALS

Product Data: Manufacturer's product data sheets for each type of site furnishing and accessory. Include installation instructions, maintenance instructions, and general recommendations regarding each product. .

1. Recycled Materials: A report of site furnishing parts consisting of recycled materials. Product specification data, providing test information for deflection and creep in accordance with ASTM D 648 and ASTM D 2990 for site furnishings which use plastic lumber as a component. The data shall provide a comparison of deflection and creep measurements to other comparable materials.

Assembly Instruction Drawings: Scaled drawings showing elevations and dimensions for each type of site furnishing. Indicate details of layout; spacings, sizes, shape and thicknesses of materials; and methods of mounting and anchoring.

Finishes: Provide data of manufacturer's standard color selections and finishes. Identifying colors and finishes proposed for use for each item of site furnishing.

Certificates:

1. Primer Certificate: Submit a certificate from the manufacturer stating that the primer conforms to the specified requirements.

2. Powder Coatings Certificate: Submit a certificate from the manufacturer stating that the powder coat conforms to the specified requirements.

Manufacturer's certificate of compliance.

QUALITY ASSURANCE

Manufacturer's Qualifications: Materials shall be the standard products of a manufacturer regularly engaged in the production of site furnishings. The materials provided shall be of a type with satisfactory performance for at least 2 years based on testing and field experience.

DELIVERY, INSPECTION, STORAGE AND PROTECTION

Deliver, handle, and store materials in accordance with the manufacturer's recommendations. Inspect delivered site furnishings upon arrival at the work site to confirm products conform to requirements.

Store items in designated area free from contact with soil and protected from weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

MATERIALS

Anchors and Hardware: Provided, where necessary, for fastening site furnishings securely in place and in accordance with approved manufacturer's instructions. Anchoring devices that may be used, when no anchors are otherwise specified or indicated, include anchor bolts, slotted inserts, expansion shields for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; and lag bolts and screws for wood.

1. Anchor bolts : ASTM A 307.

2. Threaded Inserts and Expansion Anchors: Provide inserts recessed not less than 2.5 inches into concrete or masonry. Pullout 198 pounds in concrete with f'c of 3,000 psi, as tested per ASTM E 488. Expansion shields shall conform to FS A-A-1925, group II, type 4, class 1. Provide embeddment required by manufacturer.

3. Lag Screws and Bolts: ANSI B18.2.1, type and grade best suited for the purpose.

4. Toggle Bolts: ANSI B18.2.1.

5. Bolts, Nuts, Studs and Rivets: ASME B18.2.2 or ASTM A 307.

6. Power Driven Fasteners: Follow safety provisions of ANSI A10.3.

7. Screws: ANSI B18.2.1, ASME B18.6.2, and ASME B18.6.3.

8. Washers: Provide plain washers to conform to ASME B18.22M ASME B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.2M ASME B18.21.1.

BENCHES AND CHAIRS

General: Benches and chairs shall be furnished with no sharp edges or protruding hardware.

1. Height: The height above finished grade or specified surface shall be between 18-20 inches and level.

2. Seat: The seat surface shall be pitched or slotted to shed water; the seat depth shall be between 12-18 inches and pitched down at the back at a 0-5 degree angle. Seat shall have a minimum width of 24 inches per person, and shall overhang the support base by a minimum of 4 inches for heel space and to facilitate rising from a seating position.

3. Weight Limit: Seats shall support a minimum 300 lbs for each person they are designed to accommodate.

Precast Units: Design precast units in accordance with manufacturer's standards, size as indicated. Finish and color as indicated selected from manufacturer's standards.

1. Precast Concrete/Cast Stone Units: Provide reinforced precast concrete units consisting of a mixture of cement, aggregates and mineral colors suitable for exterior use at locations indicated.

    a. Design benches to sustain a live load of not less than 200 pounds per square foot.
    b. Portland cement: ASTM C 150 Type I II or III.
    c. Aggregate: ASTM C 33, maximum size 3/4 inch.
    d. Reinforcing steel: ASTM A 615/A 615M.
    e. Galvanized wire mesh: ASTM A 185.
    f. Integral color: ASTM C 979, pure mineral oxide, limeproof and non-fading.
    g. Provide minimum 5000 psi 28 day compressive strength concrete, maximum five percent absorption.
    h. Admixture: ASTM C 260 for air-entraining.

WASTE RECEPTACLES AND PLANTERS

Waste receptacles shall be furnished with weather protection, odor containment, and insect/animal-proofing. Container size shall be as indicated.

1. Height: Trash and litter deposit openings shall be between 30-40 inches above the ground.

2. Liners: Trash and litter receptacles shall be furnished with disposable inner-linings. Self-dumping type designs to include hinged bottom, top or sides will be rejected.

3. Anchors: Trash and litter receptacles that can be anchored to resist overturning by typical use, high winds, or animals shall be furnished and anchored in accordance with the manufacturer's recommendations.

4. Openings: Reinforced fiberglass funnels; openings for trash and litter insertion shall be a minimum of 4 inches in diameter. Edges of the openings shall be crimped, rounded and smoothed.

5. Ash Receptacles: The Contractor shall provide ash receptacles with a fire-proof metal bowl or screen or sand-filled containers for ash containment. Ash receptacles shall have a minimum diameter of 8 inches; ash containers shall have a fire-proof metal bowl or screen and shall be easily removable for cleaning.

6. Drainage Planter:
   a. A minimum of one drainage hole in the base of each urn and a minimum 1/8 inch space, in 2 locations, between the base of the planter and the supporting surface.

   b. Base: The planter base shall be capable of supporting the weight of the planter filled with both the designated plant material, ¾" gravel and fully saturated potting soil per plan. The urn shall not crack, overturn, or sink below the existing grade. Planters shall allow for relocation.

Precast Concrete/Cast Stone Units: Provide reinforced precast concrete waste receptacles,ash receptacles, and drainage urns consisting of a mixture of cement, aggregates, and mineral colors suitable for exterior in locations indicated.

1. Portland Cement: ASTM C 150, gray, Type I.
2. Aggregate: ASTM C 33, No. 8 crushed limestone and sand.
3. Galvanized Steel Mesh: ASTM A 185.
4. Integral Color: ASTM C 979, pure mineral oxide, limeproof and non-fading.
5 Concrete Strength: 4000 psi minimum compressive strength at 28 days.
6. Admixture: ASTM C 260 for air-entraining.

PART 3 EXECUTION

EXAMINATION

Verify that finished grades and other operations affecting mounting surfaces have been completed prior to the installation of site furnishings.

INSTALLATION

Install site furnishings plumb and true, at locations indicated, in accordance with the approved manufacturer's instructions.

Assembly and Erection of Components: Items shall be shipped knocked-down (KD) ready for site assembly. Packaged components shall be complete including all accessories and hardware. New parts shall be acquired from the manufacturer; substitute parts will not be accepted unless approved by the manufacturer. When the inspection of parts has been completed, the site furnishings shall be assembled and anchored according to manufacturer's instructions or as indicated. When site furnishings are assembled at the site, assembly shall not interfere with other operations or pedestrian and vehicular circulation.

Anchorage, Fastenings, and Connections:

Furnish metal work, mounting bolts or hardware in ample time for securing into concrete or masonry as the work progresses. Provide anchorage where necessary for fastening furniture or furnishings securely in place.

Provide, for anchorage not otherwise specified or indicated, slotted inserts, expansion shields, and power-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood.

Do not use wood plugs in any material.

Provide non-ferrous attachments for non-ferrous metal.

Make exposed fastenings of compatible materials, generally matching in color and finish the fastenings to which they are applied.

Conceal fastenings where practicable.

WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

TESTING

Each site furnishing shall be tested to determine a secure and correct installation. A correct installation shall be according to the manufacturer's recommendations and by the following procedure:

1. Measure the physical dimensions and clearance of each installed site furnishing for compliance with manufacturer's recommendations and as indicated.

2. Site furnishings which do not comply shall be reinstalled.

3. Fasteners and anchors determined to be non-compliant shall be replaced.

4. Provide a written report describing the results of the testing.

RESTORATION AND CLEAN UP

Following installation, clean up the work site and restore existing areas that have been damaged from the installation operation to original condition.

Clean and repair site furnishing surfaces of dirt, stains, filings, and other blemishes occurring from shipment and installation using agents. Cleaning methods and agents shall be according to manufacturer's instructions.

Protection: Protect site furnishing areas as required or directed by the Engineer with barricades and signage.

Disposal of Materials: Excess and waste material shall be removed and legally disposed off State property.

RE-INSTALLATION

Where re-installation is required: Re-install the product as specified. Material acquisition of replacement parts shall be the responsibility of the Contractor. Provide replacement materials that are new and supplied by the original manufacturer to match.

SECTION 12-3. CONCRETE AND REINFORCEMENT

12-3.01 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing cast-in-place concrete facilities in accordance with the details shown on the plans and these special provisions.

Whenever the 28-day compressive strength shown on the plans is 3,000 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28-day compressive strengths shown on the plans which are less than 3,000 psi , are shown for design information and are not to be considered a requirement for acceptance of the concrete.

Related Work: Compressive strength concrete shall conform to the requirements in Section 90-9, "Compressive Strength," of the Standard Specifications.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, installation and use recommendations for admixtures, expansion joint material, vapor barrier, hardener, and sealer shall be submitted for approval.

Descriptive data shall be delivered to the Engineer at the jobsite.

QUALITY ASSURANCE

Certificates of Compliance:

Certificates of Compliance shall be furnished for cement, reinforcement, epoxy products, and admixtures in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Integrally Colored Concrete Sample:

Prior to placing colored concrete, the Contractor shall successfully complete one or more integrally colored concrete samples at a location selected by the Engineer. Samples shall be constructed, finished and cured with the materials, tools, equipment, personnel, and methods to be used in completing the work.

The integrally colored concrete sample shall be a minimum of 10' x 10' x 6" in size. Each joint type shall be included in the sample. The accepted sample shall provide a visual standard for the work.

The sample shall remain through the completion of the work and shall either be removed and disposed of or become a part of the completed work.

PART 2 - PRODUCTS

CONCRETE MIXES

Concrete (Structural Work):

Commercial quality concrete shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 564 pounds of cement per cubic yard; 0 to 2-inch penetration, inclusive, as determined by California Test 533.

Concrete (Minor Work):

Commercial quality concrete for concrete curbs, sidewalks, driveways, gutter depressions, new door openings, and collars shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 470 pounds of cement per cubic yard; 0 to 2-inch penetration, inclusive, as determined by California Test 533.

Concrete (Sewer Structures):

Commercial quality concrete for sewer structures, vehicle washracks and mudrinse slabs, shall be proportioned to provide a workable mix suitable for the intended use; shall have not less than 658 pounds of a mixture of Type II cement and 15 percent by weight of a mineral admixture or Type IP (MS) Modified cement; 0 to 2-inch penetration, inclusive, as determined by California Test 533.

The air content of the freshly mixed concrete shall be 6 ± 1½ percent, as determined by California Test 504.

CONCRETE MATERIALS

Cement: Cement shall conform to ASTM Designation: C 150, Types II, or III portland cement; or Type IP (MS) Modified cement. Type IP (MS) Modified shall conform to ASTM Designation: C 595 and shall be comprised of an intimate mixture of Type II Modified cement and not more than 20 percent of a pozzolanic material.

Aggregates:

Aggregates shall be free from deleterious coatings, clay balls and other extraneous materials.

Admixtures: Admixtures used in portland cement concrete shall be included on the Department's current list of approved admixtures, and shall conform to ASTM Designation: C 494, Types A, B, D, F or G for chemical admixtures; ASTM Designation: C 260 for air-entraining admixtures; and ASTM Designation: C 618 for mineral admixtures, except loss on ignition shall not exceed 4 percent. Properties of admixtures shall be uniform in each lot.

Coloring for Concrete: Coloring for portland cement concrete shall be chemically inert, fade resistant mineral oxide or synthetic type. Integrally colored concrete admixture shall be a water reducing admixture containing no calcium chloride with coloring agents that are lime-proof and ultra-violet resistant. Colored admixture shall conform to the requirements of ACI 303.1, ASTM C979, ASTM C494, and AASHTO M194. Raw pigments are not equivalent and may not be substituted. Curing compound for integrally colored concrete shall comply with ASTM C309 and be of same manufacturer as colored admixture.

FORM MATERIALS

Forms for Exposed Finish Concrete:

Forms for exposed surfaces shall be plywood, metal or other panel type materials. Plywood shall be not less than 5/8 inch thick and without scars, dents, and delaminations. Forms shall be furnished in largest practical pieces to minimize number of joints.

Plywood shall conform to the requirements of U. S. Product Standard PS-1 for Exterior B-B (Concrete Form) Class I.

Forms for edges of slabs shall be nominal 2-inch solid stock lumber, plywood, or metal forms.

Forms for Unexposed Finish Concrete: Forms for unexposed finish concrete surfaces shall be plywood, lumber, metal or other acceptable material.

Forms for Cylindrical Columns or Supports: Forms for cylindrical columns shall be metal, fiberglass reinforced plastic, paper or fiber tubes. Paper or fiber tubes shall be constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for protection against weather or moisture.

Form Ties: Form ties shall be factory fabricated, removable or snapoff metal ties for use as necessary to prevent spreading of forms during concrete placement.

Form Oil: Form oil shall be commercial quality form oil which will permit the ready release of the forms and will not discolor the concrete.

REINFORCING MATERIALS

Bar Reinforcement: Bar reinforcement shall conform to ASTM Designation: A 615/A 615M, Grade 60 [420], or ASTM Designation: A 706/A 706M.

Welded Wire Fabric: Welded wire fabric shall conform to ASTM Designation: A 185.

Bar Supports: Bar supports for reinforcement shall be precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads.

EPOXY

Epoxy shall be furnished as 2 components that shall be mixed together at the site of the work.

Epoxy Resin Adhesive: Epoxy resin adhesive shall conform to State of California Specification No. 8040-21M-08 or other epoxy suitable for bonding new concrete to old.

Epoxy Mortars: Epoxy mortar and epoxy mortar surface treatment shall consist of a commercial quality, trowelable mixture consisting of epoxy and sand. Epoxy shall have a pull-off strength of not less than 1,000 psi and a 90-percent cure in 24 hours. Epoxy shall be of the type that requires no primer as a bonding agent.

Sand:

Sand for use in epoxy mortars shall be clean and shall have a moisture content of not more than 0.50-percent when tested in accordance with California Test 226.

Sand for epoxy mortar surface treatment shall be graded such that 100-percent passes the No. 100 sieve.

RELATED MATERIALS

Anchor Bolts, Nuts, and Washers:

Nonheaded anchor bolts shall conform to ASTM Designation: A 36/A 36M, with a minimum hook length of 6.2 diameters.

Headed anchor bolts shall conform to ASTM Designation: F1554-04, Grade 55.

Threaded rods shall conform to ASTM Designation: A 572.

Nuts shall conform to ASTM Designation: A 563, Grade A.

Washers for anchor bolts shall be commercial quality.

Exposed anchor bolts, nuts, and washers shall be hot dipped galvanized.

Control Joints for Slab-On-Grade:

1. Unsealed Joints : Plastic strip with removable plastic tee on top; 1/2 inch minimum thickness; minimum depth of strip equal to 1/4 depth of slab.

2. Sealed Joints: Plastic strip, with depth equal to minimum 1/4 of slab depth; ½ inch minimum thickness; with removable cap on top to form groove for joint sealant.

Isolation Joint Fillers:

1. Sealed Joints: Non-Bituminous Type, ASTM D1752, Type 1, 1/2 inch minimum width by full depth with 1/2 inch deep removable plastic strip.

    a. Joint Sealant: Provide in accordance with Section 07290.

2. Unsealed Joints: Bituminous Type, ASTM D1751, 1/2 inch minimum width by full depth of slab thickness.

3. Circular Isolation Joints at Columns: Prefabricated, minimum 18 gage galvanized steel, formed in circular shape to full slab depth.

Joint Sealing Compound: ASTM C-920 Grade P&NS, Class 25, Type M.; two-part self-leveling polyurethane, for sealing of expansion (isolation) and contraction (control) joints in slabs and at junctions of slabs and vertical surfaces.

Vapor Barrier: Vapor barrier shall be not less than 15 mils thick and shall conform to the requirements of ASTM Designation: E 1745, Grade A. Tape for overlapped seams shall be as recommended by the manufacturer of the vapor barrier.

Bond Breaker: Bond breaker shall be Type I asphalt saturated organic felt or such other material approved by the Engineer.

Nonskid Abrasive Aggregate: Nonskid abrasive aggregate shall be commercial quality aluminum oxide, silicon carbide, or almandite garnet grit particles; screen size 12-30 or 14-36.

Type A Control Joints: Type A control joints shall be commercial quality, preformed, T-shaped plastic strips with detachable top flange.

Keyed Construction Joint Forms: Keyed construction joint forms shall be commercial quality, galvanized metal or plastic, factory fabricated construction joint forms. Forms shall produce a rabbeted key type joint.

Divider and Edger Strips: Divider and edger strips shall be foundation grade redwood.

Mortar: Mortar shall consist of one part cement to 2 parts clean sand and only enough water to permit placing and packing.

Curing Compound: Curing compound shall be a non-pigmented curing compound with fugitive dye conforming to the requirements of ASTM Designation: C 309, Type 1-D, Class A.

Concrete Hardener: Concrete hardener shall be commercial quality water borne penetrating type magnesium fluosilicate, zinc fluosilicate or combination thereof.

ADMIXTURES

Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option to conserve cement or to facilitate any construction operation.

Calcium chloride shall not be used in any concrete.

Admixtures shall be combined with concrete materials by methods that produce uniform properties throughout the concrete.

If more than one admixture is used, said admixtures shall be compatible with each other so that the desirable effects of all admixtures will be realized.

Mineral admixtures may be used to replace up to 15 percent of Type II portland cement provided the weight of mineral admixture used is not less than the weight of cement replaced. Mineral admixtures shall not be used to replace Type IP (MS) Modified or Type III cements. Chemical admixtures may be used to reduce up to 5 percent of the portland cement except that the cement content shall not be less than 470 pounds per cubic yard. When both chemical and mineral admixtures are used with Type II cement, the weight of cement replaced by mineral admixture may be considered as cement in determining the resulting cement content.

Mineral admixtures will be required in the manufacture of concrete containing aggregates that are determined to be "deleterious" or "potentially deleterious" when tested in accordance with ASTM Designation: C 289. The use of mineral admixture in such concrete shall conform to the requirements in this section except that the use of set retarding admixtures will not be permitted.

When the use of a chemical admixture is specified or is ordered by the Engineer, the admixture shall be used at the rate specified or ordered. If no rate is specified or ordered, or if the Contractor uses a chemical admixture for his own convenience, the admixture shall be used at the dosage normally recommended by the admixture manufacturer.

When air-entrainment is specified or is ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce concrete having the specified or ordered air content as determined by California Test 504. If the Contractor uses air-entrainment for his own convenience, the average air content shall not exceed 4 percent and no single test shall exceed 5½ percent.

Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers shall have sufficient capacity to measure at one time the total quantity required for each batch. If more than one liquid admixture is used in the concrete, a separate measuring unit shall be provided for each liquid admixture and dispensing shall be such that the admixtures are not mixed at high concentrations. When air-entraining admixtures are used with other liquid admixtures, the air-entraining admixtures shall be the first to be incorporated into the mix. Unless liquid admixtures are added to premeasured water for the batch, they shall be discharged to flow into the stream of water so that the admixtures are well dispersed throughout the batch.

BAR REINFORCING STEEL

Bending:

Reinforcing steel bars shall accurately conform to the dimensions shown on the plans.

Bars shall be bent or straightened in a manner that will not crack or break the material. Bars with kinks or improper bends shall not be used.

Hooks, bends and splices shall conform to the provisions of the Building Code Requirements for Reinforced Concrete of the American Concrete Institute.

MIXING AND TRANSPORTING CONCRETE

When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be complete within 1½ hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction of cement to the aggregates.

The temperature of mixed concrete, immediately before placing, shall be not less than 50°F nor more than 90°F.

Truck mixers or agitator shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified. The counters shall be of the continuous-registering type, which accurately register the number of revolutions and shall be mounted on the truck so that the Engineer may safely and conveniently inspect them from alongside the truck. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 86°F or above, a time less than 1½ hours may be required.

When non-agitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be complete within one hour after the introduction of cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 86°F, or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.

Each load of concrete for the work shall be accompanied by a trip ticket, a copy of which shall be delivered to the Engineer at the jobsite. The trip ticket shall show volume of concrete, weight of cement and aggregates, quantity of each admixture, quantity of water including water added at the jobsite, time of day the concrete is batched, and revolution counter readings on transit mix trucks at the times the truck is charged and unloaded.

PART 3 - EXECUTION

PREPARATION

Existing Concrete Construction:

Where fresh concrete joins existing or previously placed concrete or masonry, the contact surfaces of the existing or previously placed material shall be roughened, cleaned, flushed with water and allowed to dry to a surface dry condition immediately prior to placing the fresh concrete. The roughened surface shall be no smoother than a wood trowelled surface. Cleaning of the contact surfaces shall remove laitance, curing compounds, debris, dirt and such other substances or materials which would prevent bonding of the fresh concrete.

Abrasive blast methods shall be used to clean horizontal construction joints to the extent that clean aggregate is exposed.

Exposed reinforcing steel located at the contact surfaces that is to be encased in the fresh concrete shall be cleaned to remove any substance or material that would prevent bonding of the fresh concrete.

Forms:

Forms shall be mortar tight, true to the dimensions, lines, and grades shown on the plans, securely fastened and supported, and of adequate rigidity to prevent distortion during placing of concrete.

Forms for exposed surfaces shall be constructed with triangular fillets not less than 3/4" x 3/4" attached so as to prevent mortar runs and to produce smooth straight chamfers at all sharp edges of the concrete.

Form fasteners shall be removable without chipping, spalling, heating or otherwise damaging the concrete surface. Form ties shall be removed to a depth of at least one inch below the surface of the concrete.

The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be thoroughly coated with form oil prior to use.

Forms shall not be stripped until at least 40 hours after placing concrete, except soffit forms and supports shall not be released or removed until at least 10 days after placing concrete.

Anchorages and embedded items shall be placed and rigidly secured at their planned locations prior to placing concrete.

Reglets or embedded flashing shall be installed on concrete forms before the concrete is placed.

Redwood dividers shall have 16d galvanized nails partially driven into both vertical faces at 18 inches on center.

Vapor Barrier:

Vapor barrier shall be installed in conformance with the manufacturers recommendations and shall be protected with a 3-inch layer of clean uncompacted sand cover.

Unless otherwise shown on the plans, vapor barrier shall be placed under portions of the floor slab scheduled to receive finish flooring.

Placing Reinforcing Steel:

Reinforcing steel bars shall be accurately placed to the dimensions shown on the plans.

Bar reinforcement conforming to ASTM Designation: A 615/A 615M, Grade 60 [420], or A 706/A 706M shall be lapped at least 45 diameters.

Bars shall be firmly and securely held in position by means of wiring and approved bar supports. The spacing of supports and ties shall prevent displacement of the reinforcing or crushing of supports.

Tie wire shall be clear of concrete formwork and concrete surfaces.

All reinforcing steel shall be in place and inspected before concrete placement begins. Placing of bars on fresh layers of concrete will not be permitted.

Within areas where epoxy-coated reinforcement is required, tie wire and bar chairs or other metallic devices used to secure or support the reinforcement shall be plastic-coated or epoxy-coated to prevent corrosion of the devices or damage to the coated reinforcement.

Ground Bar: A continuous reinforcing steel bar shall be installed in the building foundation at the location indicated on the plans for the electrical ground bar. The use of epoxy coated reinforcing bar is not permitted. The end of the ground bar shall extend beyond the concrete surface and shall be protected from damage by construction operations.

PLACING CONCRETE

Concrete shall be placed and consolidated by means of internal vibrators to form dense, homogeneous concrete free of voids and rock pockets.

Forms and subgrade shall be thoroughly moistened with water immediately before placing concrete.

Concrete shall be placed as nearly as possible to its final location and the use of vibrators for extensive shifting of the concrete will not be permitted.

Concrete shall be deposited and consolidated in a continuous operation within limits of construction joints, until the placing of the panel or section is completed.

When concrete is to be placed in large areas requiring more than two pours, concrete shall be placed in alternate long strips between construction joints and the final slab infilled.

Vibrators used to consolidate concrete containing epoxy-coated bar reinforcement shall have a resilient covering to prevent damage to such reinforcement.

FINISHING CONCRETE SURFACES

Finishing Unformed Surfaces:

Slabs shall be placed full thickness to finish elevation and leveled to screeds by use of long straightedges. The screeds shall be set to grade at approximately 6-foot centers. After leveling, screeds shall be removed and the surface shall be floated with wooden floats.

Type A control joint strips shall be inserted into the floated concrete so that the bottom of the top flange is flush with the finish elevation. Strips shall be standard manufactured lengths and shall be placed on an approximate straight line. The top flange of the strips shall be removed after the concrete has set and cured.

The floated surface shall be trowelled with steel trowels. Troweling shall form a dense, smooth and true finish. Walkways, pedestrian ramps, stairs and outdoor slabs for pedestrian traffic shall be given a non-slip broom finish unless a different finish is called for on the plans or in these special provisions.

The application of cement dust coat will not be permitted.

Steel trowel finish and broom finish will not be required for slabs to receive exposed aggregate finish nor for slabs to be covered with ceramic tile.

Concrete floor surfaces to receive ceramic tile shall be floated to grade and then, before final set of the concrete, the floated surfaces shall be roughened with stiff bristled brushes or rakes.

Finished surfaces of floor slabs shall not deviate more than 1/8 inch from the lower edge of a 10-foot long straight edge.

Finishing Formed Surfaces:

Formed concrete surfaces shall be finished by filling holes or depressions in the surface, repairing all rock pockets, and removing fins. All surfaces of formed concrete exposed to view shall have stains and discolorations removed, unsightly bulges removed, and all areas which do not exhibit the required smooth, even surface of uniform texture and appearance shall be sanded with power sanders or other approved abrasive means until smooth, even surfaces of uniform texture and appearance are obtained.

Cement mortar, patching and finishing materials used to finish exposed surfaces of concrete shall closely match the color of surrounding surfaces.

Nonskid Abrasive Aggregate Finish: Where shown on the plans, walkways shall receive a nonskid abrasive aggregate (grit) finish. The grit shall be applied uniformly at the rate of not less than 0.3 pound per square foot and tamped into the floated concrete surface while the concrete is plastic. The grit shall be buried about 0.7 diameter of each particle into the concrete.

Minimum coefficient of friction	0.6 at slopes less than 6 percent 0.8 at slopes greater than 6 percent

Broom Finish:

Medium Finish	slopes less than 6 percent
Heavy Finish	slopes greater than 6 percent

CURING CONCRETE

Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperatures.

Initial curing of floor slabs shall start as soon as free water has disappeared from the concrete surface. The concrete shall be kept continuously wet by application of water for not less than 7 days after the concrete has been placed.

Cotton mats, rugs, carpets, or sand blankets may be used as a curing medium to retain the moisture during the curing period. Curing materials that will stain or discolor concrete shall not be used on surfaces exposed to view.

Prior to placing the curing medium, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is covered with the curing medium. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

Concrete surfaces, other than floor slabs, shall be kept moist for a period of at least 5 days by leaving the forms in place or by covering the exposed surfaces using moist rugs, cotton mats or other curing materials approved by the Engineer.

Concrete curbs, sidewalks, collars, and gutter depressions may be cured with a curing compound.

Integrally colored concrete shall be cured according to the curing compound manufacturer's instructions using the manufacturer's recommended techniques.

PROTECTING CONCRETE

Concrete shall not be placed on frozen or frost covered surfaces.

Concrete shall be protected from damage due to rain, freezing or inclement weather, and shall be maintained at a temperature of not less than 40°F for 72 hours. When required by the Engineer, the Contractor shall provide a written outline of his proposed methods of protecting concrete.

Vehicles, equipment, or concentrated loads weighing more than 300 pounds individually and material stockpiles weighing more than 50 pounds per square foot will not be permitted on the concrete within 10 calendar days after placing.

SPECIAL TREATMENTS

Concrete Hardener:

Chemical concrete hardener shall be applied to the floor surfaces shown on the plans. Surfaces shall be clean and dry before the application of hardener.

The solution shall be applied in accordance with the manufacturer's instructions.

After the hardener has dried, the surface shall be mopped with water to remove encrusted salts.

Concrete Sealer: Concrete sealer shall be applied to the concrete surfaces designated on the plans in accordance with the manufacturer's instructions for heavy duty use. The sealer shall be applied to dry concrete surfaces.

Epoxy Resin Adhesive: Epoxy resin adhesive shall be applied to concrete surfaces shown on the plans. Epoxy resin adhesive shall be mixed and applied in accordance with the manufacturer's recommendations.

Epoxy Mortars:

Epoxy for use as a binder in epoxy mortars shall be thoroughly mixed together before the aggregate is added, and unless otherwise specified, the mix proportions shall consist of one part binder to approximately 4 parts of aggregate, by volume.

All surfaces against which epoxy mortars are to be applied shall be free of rust, paint, grease, asphalt, and loose or deleterious material.

12-3.02 ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing and erecting precast concrete caps at low masonry walls, drywell, and precast sills in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Working Drawings:

Complete working drawings showing dimensions, location of cast items, reinforcement, and other pertinent information shall be submitted for approval.

Working drawings shall also include a location plan which shows the location and identification of each Architectural precast concrete element.

QUALITY ASSURANCE

Codes and Standards: Welds shall conform to the requirements in AWS D1.1, "Structural Welding Code - Steel," for steel shapes and AWS D1.4, "Structural Welding Code - Reinforcing Steel," for bar reinforcing steel.

Fabricate and erect precast concrete members within tolerances recommended in PCI MNL-117.

Submit control samples to Engineer for approval.

PART 2 - PRODUCTS

MATERIALS

Architectural Precast Concrete products shall conform to the requirements of structural work under "Cast-in-Place Concrete" in Section 12-3 “Concrete and Reinforcement” of these special provisions.

Substitute white Portland cement and crushed white aggregate where required to achieve colored concrete matching the approved control sample.

FABRICATION

Manufacture precast concrete units in accordance with PCI MNL-117, PCI “Architectural Precast Concrete”, and applicable requirements of ACI 318/318R, Chapter 16. Forms shall be accurately constructed to produce members to dimension, shape, configuration, and profile indicated. When not otherwise indicated, construct forms to produce smooth concrete. Members shall be moist cured in accordance with curing requirements specified in PCI MNL-117. Provide finishes for exposed concrete matching approved samples and mock-ups and the approved control samples.

PART 3 - EXECUTION

ERECTION AND INSTALLATION

The requirements of this special provision are in addition to the applicable requirements for concrete (structural work) and bar reinforcing steel in "Cast-in-Place Concrete," elsewhere in this Section 12-3.

Transport and erect precast members in accordance with PCI MNL-117.

Erection:

Precast concrete units shall not be erected until at least 75 percent of the design strength shown on the plans has been attained and verified by the Contractor.

Provide anchorage and attachment as indicated in accordance with PCI MNL-117 Division VI. Provide touch up painting of field welds and abraded surfaces.

At completion, units shall be plumb, level, and square, true to line, with edges and angles parallel with related building lines.

Welding: Panels shall be welded to supports as shown on the plans.

PATCHING

Holes in panels caused by lifting and bracing devices shall be patched as specified for other concrete work.

FIELD QUALITY CONTROL

Testing: Concrete strength at the time of lifting shall be verified with tests conducted by the Contractor.

12-3.03 DRILL AND GROUT DOWELS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of drilling holes in existing concrete and installing and grouting bar reinforcing steel dowels into such drilled holes in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS

Grout: Grout shall be a neat cement paste consisting of portland cement and water. The water content of the grout shall be not more than 4 gallons per 94 pounds of cement.
Dowels: Dowels shall be bar reinforcing steel, as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

PART 3 - EXECUTION

Installation:

The holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the holes. The diameter of drilled holes shall be 1/4 inch larger than the nominal diameter of the dowels unless otherwise shown on the plans.

Immediately prior to placing the dowels, the holes shall be cleaned of dust and other deleterious materials, shall be thoroughly saturated with water, have all free water removed and the holes shall be dried to a saturated surface dry condition.

Grout shall not be retempered.

Sufficient grout shall be placed in the hole so that no voids remain after the dowels are inserted.

Grout shall be cured by keeping the surface of the grout continuously damp. Grout shall be cured for a period of at least 3 days or until the dowels are encased in concrete.

Dowels or grout which fail to bond or are damaged before new concrete is placed shall be removed and replaced.

12-3.04 DRILL AND BOND DOWELS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of drilling holes in existing concrete and installing and bonding bar reinforcing steel dowels into such drilled holes in existing concrete in accordance with the details shown on the plans and these special provisions.

PART 2 - PRODUCTS

Bonding Material: The bonding material shall be magnesium phosphate concrete, either single component (water activated) or dual component (with a prepackaged liquid activator), as approved by the Engineer.

Dowels: Dowels shall be bar reinforcing steel, as specified under "Cast-In-Place Concrete" in Section 12-3, "Concrete and Reinforcement," of these special provisions.

PART 3 - EXECUTION

Installation:

The holes shall be drilled by methods that will not shatter or damage the concrete adjacent to the holes. The diameter of drilled holes shall be 1/2 inch larger than the nominal diameter of the dowels unless otherwise shown on the plans.

Immediately prior to placing the dowels, the holes shall be cleaned of dust and other deleterious materials, and the holes shall be dry.

Sufficient bonding material shall be placed in the hole so that no voids remain after the dowels are inserted.

Dowels which fail to bond or are damaged before new concrete is placed shall be removed and replaced.

Magnesium phosphate concrete shall be formulated for minimum initial set time of 15 minutes and minimum final set time of 25 minutes at 70°F. The materials, prior to use, shall be stored in a cool, dry environment.

Mix water used with water activated material shall be free from oil and impurities and contain not more than 2,000 parts per million as Cl nor more than 1,500 parts per million of sulfate as SO_4.

The quantity of water for single component type or liquid activator for dual component type to be blended with the dry component, shall be within the limits recommended by the manufacturer and shall be the least amount required to produce a pourable batter.

Magnesium phosphate concrete shall not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper metals.

The surface of any dowel coated with zinc or cadmium shall be coated with a colored lacquer before installation of the dowel. The lacquer shall be allowed to dry thoroughly before embedment of said dowels.

SECTION 12-4. MASONRY

12-4.01 CONCRETE MASONRY UNITS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing reinforced hollow concrete masonry units in accordance with the details shown on the plans and these special provisions. Concrete masonry units shall include modular/precision faced, split faced, and burnished faced units.

Related Work:

Water repellent coating shall be applied in accordance with the requirements specified under "Water Repellent Coating" in Section 12-7, "Thermal and Moisture Protection," of these special provisions

PERFORMANCE REQUIREMENTS

Unit Strength: Provide masonry units that develop the following installed compressive strengths (f'm) at 28 days:

Based on net area f'm = 2,000 psi

SUBMITTALS

Product Data: Submit manufacturer's product data for block, including available color range,
Samples: Submit full-size sample of block and samples of colored mortar for approval. Block and colored joint mortar require approval of the Engineer before they may be used in the concrete masonry work.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall show all materials required, providing necessary plans, sections, and elevations showing masonry layout of the different masonry units to be used. Drawings shall include all sizes, textures, and the extent of their installation and other necessary details showing anchoring attachments to other building components.

QUALITY ASSURANCE

Masonry Preconstruction Testing Service:

The Contractor shall employ and pay all costs for the services of a testing laboratory acceptable to the Engineer and experienced in performing preconstruction masonry tests. The testing laboratory shall comply with the requirements of ASTM Designation: E 329.

Preconstruction tests shall be performed on the following materials by the Unit Strength Method as defined by Section 2105, "Quality Assurance," of the CBC:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.

Grout shall be tested in accordance with ASTM Designation: C 1019.

In addition:

Mortar shall be tested in accordance with UBC Standard: 21-16.

Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made.

Single Source Responsibility:

Exposed masonry units of uniform color and texture shall be obtained from one manufacturer for each different product required for each continuous surface or visually related surfaces.

Mortar ingredients of uniform quality, including color for exposed masonry, shall be obtained from one manufacturer for each cementitious component and from one source and producer for each aggregate.

Certificates of Compliance: Certificate of Compliance shall be furnished for masonry units, aggregate for grout and transit mixed grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE

Delivery: Masonry materials shall be delivered to the project in an undamaged condition.

Storage and Handling: Masonry units shall be stored and handled in order to prevent deterioration or damage due to moisture, temperature changes, contamination, corrosion or other causes.

PART 2 - PRODUCTS

CONCRETE MASONRY UNITS

Concrete Masonry Units:

Concrete masonry units shall be nominal size, color and architectural finish as shown on plans; hollow load bearing,medium weight, Grade N, Type II, conforming to ASTM Designation: C 90; standard or open ended masonry units.

Special shapes shall be provided where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

Split face concrete masonry units shall conform to ASTM C90. Face of units shall have special surface textured split-face, scored to dimensional module indicated. Minimum strength requirements shall apply. Split face block shall have integral color as selected by the Engineer from manufacturer’s standards.

Burnished concrete masonry units shall conform to ASTM C90. Face of units shall have special surface textured burnished-face, scored to dimensional module indicated. Burnished units shall reveal the inner matrix of the material by removing the cmu surface to expose the aggregates. The result shall be a precision, smooth-surfaced unit with the look of granite. Minimum strength requirements shall apply. Burnished block shall have integral color as selected by the Engineer from manufacturer’s standards.

Precision face concrete masonry units shall conform to ASTM C90. Face of units shall be standard smooth face.

MORTAR AND GROUT MATERIALS

Cement:

Cement for mortar shall be Type II, low alkali portland cement conforming to ASTM Designation: C 150; or masonry cement conforming to ASTM Designation: C 91.

Cement for grout shall be Type II portland cement conforming to ASTM Designation: C 150 with maximum 15 percent Class N, F, or C mineral admixture conforming to ASTM Designation: C 618 except that the loss on ignition shall not exceed 4 percent; or Type IP(MS) blended hydraulic cement conforming to ASTM Designation: C 595.

Aggregate:

Aggregate for mortar shall conform to ASTM Designation: C 144, except not more than 10 percent shall pass the No. 100 sieve.

Aggregate for grout shall conform to ASTM Designation: C 404, except 100 percent of the coarse aggregate shall pass the 3/8-inch sieve. Soundness loss shall not exceed 10 percent as determined by California Test 214.

Coloring for Mortar: Coloring for mortar shall be chemically inert, fade resistant mineral oxide or synthetic type.

Lime: Lime shall conform to ASTM Designation: C 207, Type S.

Premixed Mortar or Grout: A premixed packaged blend of cement, lime, and sand, with or without color, that requires only water to prepare for use as masonry mortar or grout may be furnished. Packages of premix shall bear the manufacturer's name, brand, contents, weight, and color identification.

Transit Mixed Grout: Transit mixed grout shall conform to ASTM Designation: C 94, except aggregate shall be as specified herein for aggregate for grout. The minimum compressive strength shall be 2,500 psi at 28 days when tested in accordance with ASTM Designation: C 39. Admixtures, if used, shall conform to ASTM Designation: C 494, Types A, E or F and shall not contain chlorides.

REINFORCEMENT, TIES AND ANCHORING DEVICES

Bar Reinforcement: Bar reinforcement shall conform to ASTM Designation: A 615/A 615 M, Grade 60, or ASTM Designation: A 706/A 706 M.

Anchor Bolts: Anchor bolts shall conform to ASTM Designation: A 36/A 6M with a minimum hook length of 6.2 diameters, and shall be 1/2-inch diameter unless otherwise shown on the plans.

Anchors, Ties, Angles, and Metal Lath: Anchors, ties, angles, and metal lath shall be commercial quality, and shall be galvanized.

Dry Pack: Dry pack to set items into masonry shall be one part portland cement to not over 3 parts of clean sand and with a minimum amount of water for hydration and packing.

PROPORTIONING MORTAR AND GROUT

Mortar shall be proportioned by loose volume and shall have one part cement, one quarter part of hydrated lime and 2¼ to 3 parts aggregate. Mortar shall be tinted with coloring to match the masonry units.

Grout, except transit mixed and packaged premix grout, shall be proportioned by loose volume and shall have one part cement, not more than 1/10 part hydrated lime, 2¼ to 3 parts sand aggregate, and not more than 2 parts gravel aggregate.

Aggregate shall be measured in a damp loose condition.

Grout shall be mixed with sufficient water to produce a mix consistency suitable for pumping without segregation. Slump shall not exceed 9 inches.

PART 3 - EXECUTION

CONSTRUCTION

Masonry units shall be laid in running bond, except as otherwise shown on the plans.

Surfaces of metal, glass, wood, completed masonry, and other such materials exposed to view shall be protected from spillage, splatters and other deposits of cementitious materials from masonry construction. All such deposits shall be removed without damage to the materials or exposed surfaces.

Construction will comply with Section 2104, "Construction," of the CBC. Tolerances specified in Section 2104 shall be in affect unless otherwise shown on the plans.

Where fresh masonry joins concrete or masonry, the contact surfaces of existing material shall be roughened, cleaned and lightly wetted. The roughened surface shall be no smoother than a wood troweled surface. Cleaning shall remove laitance, curing compounds, debris, dirt and any substance which decreases bond to the fresh masonry.

Masonry shall not be erected when the ambient air temperature is below 40°F.

Surfaces of masonry erected when the ambient air temperature exceeds 100°F. shall be kept moist with water for a period of not less than 24 hours. Water shall be uniformly applied with a fog spray at the intervals required to keep the surfaces moist but not to exceed 3 hours unless otherwise approved by the Engineer.

All anchors, bolts, dowels, reglets and other miscellaneous items to be cast into the wall shall be firmly secured in place before grout is poured.

Shoring for concrete masonry lintels shall remain in place a minimum of 15 days after the wall has been completed.

Laying Masonry Units:

Concrete masonry units shall be laid dry.

During laying of units all cells shall be kept dry in inclement weather by suitably covering incomplete walls. Wooden boards and planks shall not be used as covering materials. The covering shall extend down each side of masonry walls approximately 2 feet.

Chases shall be kept free from debris and mortar.

Bond beam units with an opening at each cross web shall be used at all horizontal reinforcing bars.

Where masonry unit cutting is necessary, all cuts shall be made with a masonry saw to neat and true lines. Blocks with excessive cracking or chipping of the finished surfaces exposed to view will not be acceptable.

Lintels: Masonry lintels shall be as shown on the plans. Lintels shall be formed using U-shaped lintel units with reinforcing bars placed as shown on the plans. Formed-in-place lintels shall be temporarily supported.

Bar Reinforcement:

Bar reinforcement shall be accurately positioned in the center of the cell and securely held in position with either wire ties or spacing devices near the ends of bars and at intervals not exceeding 192 bar diameters. Wire shall be 16-gage or heavier. Wooden, aluminum, or plastic spacing devices shall not be used. Tolerances for the placement of vertical reinforcement in walls and flexural elements shall be ± ½ inch. Tolerance for longitudinal reinforcement in walls shall be ± 2 inches.

The minimum spacing for splices in vertical reinforcement for masonry walls shall be 4 feet plus lap.

Bar reinforcement shall not be placed in the plane of mortar joints.

Mortar:

Mortar joints shall be approximately 3/8 inch wide. Units shall be laid with all head and bed joints filled solidly with mortar for the full width of masonry unit shell. Head joints shall be shoved tight. Exposed joints shall be concave, tooled smooth, unless otherwise shown on the plans.

Mortar that has been mixed more than one hour shall not be retempered.

Mortar placed in joints shall preserve the unobstructed vertical continuity of the concrete filling. Any overhanging mortar projecting more than ½ inch, or other obstruction or debris shall be removed from the inside of such cells.

GROUTING

All cells shall be filled solidly with grout. All grout in the cells shall be consolidated at the time of placement by vibrating and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Slicing with a trowel is not acceptable.

Masonry units may be placed full height of the masonry work before grouting, or they may be placed in increments for individual grout pours.

Cleanouts shall be provided for all grout pours over 5 feet in height. Such cleanouts shall be provided in the bottom course at every cell containing vertical reinforcement. After cell inspection, the cleanouts shall be sealed before filling with grout.

Masonry units shall be placed full height of the grout pour. Grout shall be placed in a continuous pour in grout lifts not exceeding 6 feet. The interruption between placing successive lifts of grout shall be not more than one hour.

Between grout pours, a horizontal construction joint shall be formed by stopping the grout a minimum of 1½ inches below the top of the last course, except if the joint is at a bond beam, it shall be ½ inch below the top of the bond beam unit, or at the top of the wall.

CLEANING AND PROTECTING MASONRY

Splashes, stains or spots on the faces of the masonry exposed to view shall be removed.

Completed masonry shall be protected from freezing for a period of at least 5 days.

FIELD QUALITY CONTROL

The Contractor shall employ, at his own expense, a special inspector and testing laboratory to perform structural tests and inspections of masonry to verify that the construction conforms to the CBC in accordance with the requirements in Section 1701, "Special Inspections," and Section 2105, "Quality Assurance," of the CBC.

The Contractor shall submit a written Field Quality Control Plan that identifies the inspector, the lab, and the procedures used. The Field Quality Control Plan shall conform to these specifications and the CBC. The Contractor's Field Quality Control Plan shall be submitted to the Engineer for approval. The Engineer shall have three weeks to approve the plan.

The Contractor shall designate in the Field Quality Control Plan a masonry Quality Control Manager (QCM). The QCM shall be responsible directly to the Contractor for the quality of masonry, including materials and workmanship, performed by the Contractor and all subcontractors.

The QCM shall be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

The QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

Masonry special inspection personnel or testing firms to be used in the work shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project, except for the following conditions:

Special Inspector: The special inspector shall be, as a minimum, an International Conference of Building Officials (ICBO) certified Special Masonry Inspector. The special masonry inspector shall perform the inspections required under Section 1701.5.7., "Structural masonry" of the CBC. The special inspector shall prepare a "Daily Field Report" providing information regarding the specific operations witnessed, including placing of masonry units and bar reinforcing, grouting, fabrication of test specimens, and other observations of importance to the work.

A "Daily Field Report" is required for each day that the Special Inspector is on the jobsite. A copy of these reports shall be delivered to the Engineer on the day following the preparation.

The special inspector shall submit a final signed report to the Engineer and Contractor stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and the applicable workmanship provisions of these specifications and the CBC.

Testing:

The testing laboratory shall comply with the requirements of ASTM Designation: E 329.

Test results shall be reported in writing to the Engineer and the Contractor on the same day the tests are made.

Testing shall be done in accordance with Section 2105.3,"Compliance with f'm" of the CBC. The Contractor can establish f'm by either Sections 2105.3.2, 2105.3.3, or 2105.3.4. A set of tests shall be done for each 5,000 square feet of wall area, but not less than one test per project. Tests shall be performed on the following materials by the Unit

Test Method as defined:

Concrete masonry units shall be tested in accordance with ASTM Designation: C 140.

Grout shall be tested in accordance with ASTM Designation: C 1019.

Mortar shall be tested in accordance with UBC Standard: 21-16.

Any work not meeting the requirements of section 2105 shall be redone and retested. Sampling, inspecting, reworking and retesting of material will be done at the contractor's expense.

12-4.02 GLASS MASONRY UNITS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of constructing reinforced glass block masonry units in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Samples: Two samples of glass block units of each type, color, design and architectural finish specified shall be submitted for approval.

Samples for Verification: Sample panel consisting of 4 glass blocks with reinforced mortar joints indicated or as selected by Engineer shall be submitted for approval.

QUALITY ASSURANCE

Certificates of Compliance: Certificate of Compliance shall be furnished for glass block units in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Single Source Responsibility: Materials for glass unit masonry shall be from a single source for each type of material required.

DELIVERY, STORAGE AND HANDLING

Storage of Materials:

Unopened cartons of glass block shall be stored in a clean, cool, dry area.

Opened cartons of glass block shall be protected from rain or water run-off with tarpaulins or plastic covers.

PART 2 - PRODUCTS

MATERIALS

Glass Block Units:

Solid glass block shall be semi-transparent blocks with smooth outer faces, made by fusing together 2 solid slabs of clear, colorless glass, with manufacturer's standard white coating factory-applied on edge surfaces, 3 inches thick by 8 inches square, nominal size. Heat transmission U value shall be 1.15 hr ft^2 Deg F/BTU. Visible light transmission shall be 80%. Impact strength shall be 150 in-lb or greater.

Mortar Materials:

Portland cement shall conform to ASTM Designation: C 150, Type I, or Type II, white or gray cement.

Color pigmented mortar shall be factory prepackaged consisting of white or gray cement combined with color-fast mineral pigments to produce color indicated, or if not indicated, shall be as selected from the manufacturer's standard formulations.

Hydrated lime shall conform to ASTM Designation: C 207, Type S.

Aggregate for mortar shall be commercially produced for masonry work and be free of organic impurities and lumps of clay or shale, and conform to ASTM Designation: C 144.

Water for mortar shall be clean and potable.

Water repellent admixture shall be the manufacturer's standard dry mixture of stearic water repellent compounds, water reducing agent and fine aggregates intended to reduce capillarity in mortar.

Glass Unit Masonry Accessories:

Panel (joint) reinforcing shall be prefabricated ladder-type welded wire units with deformed continuous side rods and plain cross rods, each 0.1483 inch in diameter, not less than 10 feet long and as follows:

Hot-dip galvanized wire shall conform to ASTM Designation: A 82 for uncoated wire and ASTM Designation: A 153, Class B2, for zinc coating applied to hot-dip process after fabrication and assembly.

Spacing of side rods shall be 2 inches center to center, unless otherwise indicated.

Panel anchors shall be the glass block manufacturer's standard perforated steel strips, 0.0359-inch uncoated thickness by 1¾ inches wide by 24 inches, hot-dip galvanized after perforating to comply with ASTM Designation: A 153, Class B2.

Sealant shall be a non-staining, waterproof mastic, silicone type.

Backer rod shall be polyethylene foam, neoprene, oakum or equal as approved by the sealant manufacturer.

Mortar Mixes:

Mortar mixes shall conform to ASTM Designation: C 270, "Proportion Specification," for Type S portland cement-lime mortar. Use of masonry cement shall not be permitted.

Mortar for exterior panels shall include a waterproofing admixture in mortar mix in accordance with the manufacturer's instruction.

Pigments for color pigmented mortar shall be selected and proportioned with other ingredients to produce mortar of the required color. Pigment to cement ratio shall not exceed 1 to 10 by weight.

Mortar shall be mixed in a mechanical batch mixer to produce a stiff but workable consistency which is drier than mortar for ordinary unit masonry; mortar shall not be retempered after it has taken an initial set.

PART 3 - EXECUTION

INSTALLATION

Setting Masonry Units:

First and succeeding courses of glass unit masonry shall be set with completely filled bed and head joints, with no furrowing. Glass unit masonry shall be laid up with courses accurately spaced and coordinated with other construction; maintain 3/8-inch joint width unless otherwise indicated.

Exposed joints shall be tooled slightly concave using a jointer larger than the joint width; tooling shall be done while mortar is still plastic and before it takes a final set.

Installing Panel Reinforcing: Panel reinforcing shall be installed in horizontal joints at the spacing indicated, running continuously from end to end of panels. Panel reinforcing shall be spaced vertically as follows:

For all panels, every other course starting with the first course above the sill.

Panel reinforcing shall be placed in joints immediately above and below all opening within glass unit masonry panels.

Panel reinforcing shall be lapped not less than 6 inches where more than one length is necessary.

Installing Panel Anchors: Panel anchors shall be installed at locations indicated and in the same horizontal joints where panel reinforcing occurs. Extend panel anchors at least 12 inches into joint and bend within expansion joints at edges of panels. Panel anchors shall be attached as shown on the plans.

CLEANING

Surplus mortar:

Surplus mortar shall be removed from face of glass blocks at time joints are tooled and while still plastic.

Glass unit masonry shall be cleaned after mortar has attained final set but before it has dried on block surfaces by use of scrub brush with stiff fiber bristles and damp cloth. Abrasive cleaners, steel wool or wire brush shall not be used.

SECTION 12-5. METALS

12-5.01 STRUCTURAL STEEL FOR BUILDINGS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of fabricating, assembling, furnishing and erecting structural steel in accordance with the details shown on the plans and these special provisions.

Structural steel consists of: Steel columns, roof framing, moment frames, ledgers, plates, tabs, anchorage, stiffeners, blocking, pedestals, rafter blocking and screens, wedges, tower collars, channel frames and roof opening framing, and deck edge framing.

Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop and field, conducted by the Engineer or a qualified inspection agency. The Contractor or fabricator shall provide access to the Engineer or testing agency to places where the structural steel work is being fabricated or produced so that the required inspection and testing can be accomplished. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The testing agency may inspect the structural steel at the plant before shipment; however, the Engineer reserves the right, at any time before final acceptance to reject the material that does not conform to the contract requirements.

REFERENCES

Structural steel shall be fabricated, assembled and erected in accordance with American Institute of Steel Construction (AISC), "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."

Welding shall be in accordance with American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

SUBMITTALS

Product Data: Product data for items to be incorporated into the work, including structural steel, high strength bolts, nuts and washers and alternative connectors, shall be submitted for approval.

Working Drawings:

Working drawings and calculations shall be submitted for approval.

Working drawings shall show any changes proposed in the work, details of connections and joints exposed to the weather, details for connections not dimensioned on the plans, the sequence of shop and field assembly and erection, welding sequences and procedures. If required, the location of butt welded splices on a layout drawing of the entire structure, and the location and details of any temporary supports that are to be used.

Calculations and working drawings for falsework to be used for the erection of structural steel shall be submitted for approval. The falsework shall be designed and constructed to provide the necessary rigidity and to support loads which will be applied. Working drawings and design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

CLOSEOUT SUBMITTALS

Final Drawings:

At the completion of each building on the contract, one set of reduced prints on 60-pound (minimum) bond paper, 11 inches x 17 inches in size, of the corrected original tracings of all approved drawings for each building shall be furnished to the Engineer. An index prepared specifically for the drawings for each building containing sheet numbers and titles shall be included on the first reduced print in the set for each building. Reduced prints for each building shall be arranged in the order of drawing numbers shown in the index.

The edge of the corrected original tracing image shall be clearly visible and visually parallel with the edges of the page. A clear, legible symbol shall be provided on the upper left side of each page to show the amount of reduction and a horizontal and vertical scale shall be provided on each reduced print to facilitate enlargement to original scale.

QUALITY ASSURANCE

Qualifications for Welding: A certified copy of qualification test record for welders shall be submitted to the Engineer at the jobsite. Descriptive data for equipment for field welding structural steel, including type and electric power requirements, shall be submitted for approval.
Certificates of Compliance: Certificate of Compliance shall be furnished for structural steel products in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications. Certificate of Compliance shall include mill test certificates for each heat number used in the work.

DELIVERY, HANDLING AND STORAGE

Structural materials shall be loaded, transported, unloaded and stored so that it is kept clean and undamaged. Material shall be stored above ground on platforms, skids, or other supports. Covers and protection shall be provided to protect the materials from corrosion.

Anchorages and anchor bolts, which are to be embedded in concrete or masonry, shall be delivered in ample time to not delay the work.

PART 2 - PRODUCTS

MATERIALS

Steel Bars, Plates and Shapes: Wide flange shapes shall conform to ASTM Designation A 992. Steel bars, plates and non-wideflange shapes shall conform to ASTM Designation: A 36/A 36M or A 572/A 572M, Grade 50 [345].

Pipe: Pipe shall conform to ASTM Designation: A 53, standard weight, unless otherwise shown on the plans.

Steel Tubing: Steel tubing shall conform to ASTM Designation: A 500, Grade B

Stud Connectors: Stud connectors shall conform to ASTM Designation: A 108, Grades 1018 through 1020, cold drawn, either semi- or fully killed.

Anchor Bolts, Nuts and Washers:

Anchor bolts shall conform to ASTM Designation: F1554-04, Grade 55.

Nuts shall conform to ASTM Designation: A 563, Grade A.

Washers for anchor bolts shall be commercial quality.

Machine Bolts, Nuts and Washers:

Machine bolts and nuts shall conform to ASTM Designation: A 307.

Washers for machine bolts shall be commercial quality.

High Strength (HS) Bolts, Nuts and Washers: High strength (HS) bolts, nuts and washers shall conform to ASTM Designation: A 325.

Direct Tension Indicators: Direct tension indicators shall conform to ASTM Designation: F 959.

Tension Control Fasteners: Tension control bolts shall have a splined end extending beyond the threaded portion of the bolt and which shears off when the specified bolt tension is attained.

Structural Steel Exposed to Weather:

Inorganic Zinc Primer: Inorganic zinc primer shall be a waterborne inorganic zinc primer conforming to the requirements of AASHTO Designation: M 300, Type I or Type II. Inorganic zinc primer shall be listed on the qualified products list which may be obtained from the Transportation Laboratory, (916) 227-7000.

Mortar: Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

Screens: Screens for soffit vents shall be 4x4 or 8x8 mesh galvanized screen. Open area not less than 50 percent.

FABRICATION

Shop Fabrication and Assembly:

Workmanship and finish shall be equal to the best general practice in modern shops.

Cuts shall not deviate more than 1/16 inch from the intended line. Roughness, notches or gouges shall be removed.

Bearing stiffeners at points of loading shall be square with the web and shall have at least 75 percent of the stiffener in contact with the flanges.

Finished members shall be true to line, shall have square corners and smooth bends and shall be free from twists, kinks, warps, dents and open joints.

Exposed edges and ends of metal shall be dressed smooth, with no sharp edges and with corners slightly rounded.

Stud Connectors: Steel surfaces shall be prepared as recommended by the manufacturer of the stud connectors. Stud connectors shall be welded to the flanges of beams or girders as shown on the plans. Automatic end welding of headed stud connectors shall be in accordance with the manufacturer's instructions.

Connections:

Abutting surfaces at connections shall be clean.

Cutting and welding at the jobsite will not be allowed except as shown on the approved drawings or specifically approved by the Engineer.

Finished holes for bolts shall be cylindrical and perpendicular to the plane of the connection. Subpunched and subdrilled holes shall be ¼ inch smaller in diameter than the diameter specified for the finished hole.

Bolted Connections:

Bolts for connecting steel to steel shall high-strength bolts conforming to ASTM Designation: A 325M as shown on the plans.

High-strength structural steel bolts, or equivalent fasteners, other bolts attached to structural steel, nuts, and washers shall be galvanized by mechanically deposited coating.

Holes for Other Work:

Holes for securing other work to structural steel and passage of other work through steel framing members shall be as shown on the approved drawings.

Threaded nuts or specialty items for securing other work to steel members shall be as shown on the approved drawings.

Holes shall be cut, drilled or punched perpendicular to metal surfaces. Holes shall not be flame cut or enlarged by burning. Holes are to be drilled in bearing plates.

SHOP PAINTING

Structural steel members, except those to receive sprayed-fireproofing, shall be painted.

Structural Steel Exposed to Weather:

Surface Preparation: Surfaces of structural steel to receive inorganic zinc primer shall be blast cleaned in accordance with Steel Structures Painting Council, SSPC-SP 10, "Near-White Blast Cleaning."

Bolted Connections: Contact surfaces of high strength bolted connections and ungalvanized anchor bolt assemblies shall be blast cleaned and coated with waterborne inorganic zinc primer before assembly. The total thickness of primer on each surface shall be between 1 mil to 3 mils and may be applied in one application.

Painting:

Immediately after surface preparation, surfaces of structural steel shall receive an undercoat of waterborne inorganic zinc primer. Color shall essentially match Federal Standard 595B, No. 36373.

The manufacturer's published mixing and application instructions for inorganic zinc primer shall be followed.

Structural Steel Not Exposed to Weather:

Surface Preparation: Surfaces of structural steel to be painted shall be blast cleaned in accordance with Steel Structures Painting Council, SSPC-SP 6, "Commercial Blast Cleaning."

Bolted Connections: Contact surfaces of high strength bolted connections and ungalvanized anchor bolt assemblies shall be blast cleaned and primed with red oxide primer designed for steel surfaces before assembly. The total thickness of primer on each surface shall be between 1 mil to 3 mils and may be applied in one application.

Painting: Immediately after surface preparation, surfaces of structural steel shall receive an undercoat of red oxide primer designed for steel surfaces.

GALVANIZING

Structural steel in contact with or embedded in concrete or masonry, or designated as galvanized, shall be hot-dipped or galvanized sheet. Galvanized surfaces shall be touched up after erection. Hot dip galvanizing shall conform to ASTM A123. Exposed galvanized surfaces shall be painted prior to erection. Prepare galvanizing in accordance with American Galvanizers Association “Suggested Specification for Preparing Hot-Dip Galvanized Steel Surfaces for Painting”. Prime and paint per Section 12-9.

PART 3 - EXECUTION

ERECTION AND ASSEMBLY

Field Splices:

Field splices shall be made only at the locations shown on approved working drawings.

The parts shall be accurately assembled in their final position as shown on the plans and in true alignment with related and adjoining work before final fastening.

All parts shall be supported adequately and at locations to provide a vibration free, rigid, and secure installation.

Bolted Connections:

All high strength bolted connections shall be made with high strength bolts installed with direct tension indicator washers or tension control fasteners.

When used, one mechanically galvanized direct tension washer shall be installed with each high strength bolt. Bolts shall be tightened until a direct tension indicator washer gap is 0.005 inch or less. A zero gap will not be cause for rejection.

During installation of tension control bolts, the torque required to turn the nut on the tension control bolt shall be counterbalanced by the torsion shear resistance of the splined end of the bolt.

The bolt head type and head location shall be consistent within a joint.

Nuts shall be on side of member least exposed to view.

Setting Bases and Bearing Plates:

Concrete and masonry surfaces shall be cleaned and roughened to improve bond. Bottom of base and bearing plates shall be clean.

Base plates and bearing plates for structural members shall be set on wedges or other adjusting devices.

Anchor bolts shall be wrench tightened after supported members have been positioned and plumbed.

Mortar shall be solidly packed between bearing surfaces and base or bearing plates to ensure that no voids remain. Exposed surfaces shall be finished and allowed to cure.

FIELD PAINTING

Touch-up Painting: After erection, the Contractor shall clean field welds, bolted connections, and abraded areas of shop paint and apply the same materials as applied for shop painting.
Surfaces that are scheduled to receive finish coats shall be painted with an additional prime coat and finish coats in accordance with the requirements specified for shop primed steel under "Painting" in Section 12-9.

QUALITY CONTROL

Testing and inspection:

Ultrasonic examination shall be performed by the Contractor on at least 50 percent of all full penetration butt-welded splices in accordance with the requirements of AWS D1.1 and these special provisions.

Welding procedures and methods shall be subject to inspection for conformance with AWS D1.1.

Butt welds shall be tested in accordance with AWS D1.1, Chapter 6, Part C, Ultrasonic Testing of Groove Welds.

Examination, reporting and disposition of tests shall be in accordance with the provisions of 6.12, AWS D1.1.

In addition to ultrasonic examinations by the Contractor, welds may be subject to inspection or non-destructive testing by the Engineer.

When additional inspection or non-destructive testing is required by the Engineer, the Contractor shall provide sufficient access facilities in the shop and at the jobsite to permit the Engineer or his agent to perform such inspection and testing.

The Contractor shall correct all deficiencies in the structural steel work which inspections and laboratory test reports have indicated to be not in compliance with these special provisions. Additional tests shall be performed by the Contractor at his expense to reconfirm any non-compliance of original work, and to show compliance of the corrected work.

12-5.02 OPEN WEB STEEL JOISTS

PART 1 - GENERAL

Scope: This work shall consist of designing, fabricating, furnishing and erecting pre-engineered, factory fabricated steel joists and accessories in accordance with the detail shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturers descriptive data, layout and anchorage details, quality control manual, welder qualifications, and installation instructions shall be submitted for approval.

Working Drawings:

Complete working drawings and design calculations for the pre-engineered steel joists, permanent bracing, continuity angles and connection details shall be submitted for approval. Submittals shall be approved prior to the start of fabrication.

Working drawings shall show the size and shape of the truss members and temporary and permanent bracing members. Joint and connection details shall be shown.

Working drawings shall include a location plan which shows the location and identification of each steel joist.

Calculations for the design of the steel joists, bracing and connections shall include a list of applied loads and load combinations with the resulting member forces and member stresses. Steel joists and connections shall be designed for the chord forces shown on the plans.

Design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

If the design calculations contain or consist of computerized or tabulated calculations, the values pertaining to the design shall be identified, described or indexed in such a manner that a design review can be performed.

QUALITY ASSURANCE

Manufacturer Qualification: Steel joists shall be manufactured by a firm experienced in manufacturing steel joists similar to those specified and with a record of successful in-service performance. Manufacturer shall be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.

Codes and Standards: Steel joists and permanent bracing shall be designed for the loads shown on the plans and other applied loads, including fire sprinkler systems. The design shall be in accordance with the requirements of the CBC and the Steel Joist Institute "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders" (SJI-01).

Certificates of Compliance: Certificates of Compliance shall be furnished for steel joists in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

Identification: Each joist shall be stamped or marked with a location identification mark or symbol and with the name and address of the manufacturer.

DELIVERY, STORAGE AND HANDLING

Steel joists shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling. Covers shall be provided to protect the materials from corrosion.

Steel joists shall be handled in such a manner as to prevent damage due to bending and warping.

PART 2 - PRODUCTS

Open Web Steel Joists: Open web steel joists shall conform to SJI-01, K –Series. Joists shall be tapered and shall be designed to support the loads shown on the plans.

Bearing Plates, Fasteners and Accessories**:** Bearing plates, fasteners and accessories shall be as shown on the approved working drawings.

Anchors: Anchors shall conform to the requirements in "Building Miscellaneous Metal" specified under Section 12-5, "Metals," of these special provisions.

FABRICATION

Workmanship and finish shall be equal to the best general practice in modern steel fabrication shops. Construction shall conform to the SJI Code of Standard Practice.

Camber, if required by the design, shall be built into the joists.

CLEANING AND SHOP PAINTING

Painting: Immediately after cleaning, surfaces of steel joists shall receive a one-coat shop applied steel prime coat of red oxide ferrous metal primer at a rate to provide a dry film thickness of not less than 1.5 mils.

PART 3 - EXECUTION

EXAMINATION

The Contractor shall examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

ERECTION

Installation of joists shall be in accordance with the approved working drawings. Steel joists and bracing members shall be accurately cut to provide tightly fitted joints and connections.

Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved by the Engineer and such repairs are satisfactorily made in accordance with the manufacturer's recommendations.

Installation:

Steel joists shall be erected plumb and true and shall be secured rigidly in place in accordance with the approved working drawings. Joists shall not be field cut or otherwise altered without the written approval of the Engineer.

Temporary bracing shall be installed during erection to hold the joists plumb and true and in a safe position until sufficient permanent construction is in place to provide full stability.

Bearing plates shall have full bearing after the supporting members have been plumbed and properly positioned, prior to placing superimposed loads.

Connectors, fasteners and other hardware accessories shall be coordinated for placement in the proper locations and positions.

Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the design carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work.

All permanent bracing shall be secured in place before any sustained permanent loads are applied to the joist system.

Welding shall be by the tungsten inert gas arc welding method or the consumable electrode inert gas method. Welding processes that require the use of flux are not permitted.

All welds shall conform to the requirements of Section 8.15, "Quality of Welds," of the American Welding Society publication No. AWS D 1.1, "Structural Welding Code."

Exposed welds shall be ground smooth and flush.

CLEANING

After erection, abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

12-5.03 METAL DECK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing metal deck in accordance with the details shown on the plans and these special provisions.

Metal deck includes ribbed sheet steel decking units, bent plates, accessories, fasteners and such other components, not mentioned, but required for a rigid, secure and complete installation.

REFERENCES

The design, fabrication and erection of metal deck shall conform to the applicable requirements of the American Iron and Steel Institute (AISI) publication, "Specifications for the Design of Cold Formed Steel Structural Members," and the applicable Steel Deck Institute Design Manual and these special provisions.

Welding shall be in accordance with American Welding Society (AWS) D1.1 and D1.3, "Structural Welding Code - Sheet Steel."

SUBMITTALS

Product Data: Manufacturer's descriptive data for each type of deck and accessories shall be submitted for approval.

Working Drawings: Working drawings showing complete erection layouts, details, dimensions, deck section properties shall be submitted for approval. Drawings shall show types and gages, fastening methods, including the location, type and sequence of connections, sump pans, cut openings, surface finishes and temporary supports or bracing.

The metal deck supplier shall submit a fastening schedule and calculations stamped by an engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal roof panels, clips, and fasteners conform to the span and design loads shown on the plans and the wind uplift requirements of the CBC.

QUALITY ASSURANCE

Qualification of Field Welding:

Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."

Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

Certificates of Compliance: Certificates of Compliance shall be furnished for the metal decking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, HANDLING AND STORAGE

Metal deck units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.

Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2 - PRODUCTS

Manufacturers: Acceptable manufacturers shall be; Verco Manufacturing Co.; BHP Co.; or equal.

MATERIALS

Deck Units:

Deck units, closures and plates shall be primer painted deck and accessories conforming to ASTM Designation: A, 653 Grade 33 [230].

Finish: Finish shall be hot dipped galvanize conforming to ASTM A924; G 90.
Miscellaneous Steel Shapes:

Miscellaneous steel shapes shall conform to ASTM Designation: A 36/A 36M.

Miscellaneous steel shapes in contact with or embedded in concrete or masonry shall be hot dipped or galvanized sheet. Exposed galvanized steel shall be prepared and painted with a primer prior to erection. Prepare hot dip galvanized steel for painting in accordance with the American Galvanizing Association Suggested Specification for Preparing Hot-Dip Galvanized Steel Surfaces for Painting.

Anchor Clips, Vent Clips, Flashing, Saddle Plates, Flexible Closure Strips and Other Accessories: Anchor clips, vent clips, flashing, saddle plates, flexible closure strips and other accessories shall be as recommended by the decking manufacturer.

FABRICATION

Deck units shall be formed to span 3 or more supports, with flush, telescoped or nested 2-inch laps at ends and interlocking or nested side laps unless otherwise shown on the plans.

Deck units shall conform to the configurations, metal thickness, depth and width and section properties shown on the plans.

End bearing shall be not less than 1½ inches.

Cellular Metal Deck: Units shall be fluted section cells combined on a flat plate having interlocking type sidelaps. Provide depth, width of unit, number of cells per unit, and width of cells to match adjoining fluted sections specified.

Provide sufficient welds, forming the steel sheets into the cellular deck unit, to develop the full horizontal shear at the plane where the steel sheets are joined.

Metal Closure Strips: Metal closure strips for opening between deck units and other construction shall be fabricated from the same gage and material as the adjacent deck units. Strips shall be formed to provide tight-fitting closures at end of cells or flutes and sides of decking.

Roof Sump Pans: Sump pans shall be fabricated from single piece of galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Sump pans shall be of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Pans shall be recessed not less than 1½ inches below roof deck surface unless otherwise shown or required by deck configuration. Holes for drains shall be cut in the field.

Cleaning: When spray-on fireproofing is specified, the decking manufacturer shall supply decking free of amounts of oil or lubricants which would significantly impair the adhesion of the spray-on fireproofing.

PART 3 - EXECUTION

INSTALLATION

Deck units and accessories shall be installed in accordance with the manufacturer's recommendations and approved drawings and these special provisions.

Units shall be placed on supporting steel framework, adjusted in place and properly aligned before being permanently fastened. Ends of units shall have positive bearing over structural supports.

Cutting and fitting shall present a neat and true appearance with exposed burrs removed. Openings through the decking shall be cut square and shall be reinforced as recommended by the decking manufacturer.

The metal deck shall not be used as a working platform before deck units are fastened in place. Supplies, equipment or other loads shall not be stored on the deck. Mechanical equipment or other loads shall not be hung from metal roof decking.

Welding:

Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

Welding washers shall be used where recommended by the manufacturer.

Fastening Deck Units: Deck units shall be fastened to supporting steel members by welding, or powder or pneumatically driven fasteners as shown on the structural plans.

Fastening Side Laps: Side laps of adjacent deck units shall be fastened as shown on the plans.

Roof Sump Pans: Roof sump pans shall be placed over openings provided in roof and welded to top decking surface. Welds are to be spaced at not more than 12 inches with at least one weld in each corner. Cut opening in sump bottom to accommodate drain size indicated.

Field Painting:

Immediately following erection, field welds, bolted connections and abraded areas shall be cleaned with a wire brush.

Galvanized surfaces shall be touched-up with galvanizing repair paint recommended by the manufacturer.

12-5.04 COLD FORMED METAL FRAMING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing cold formed metal framing, including load-bearing and non-bearing steel studs, and "C"-shaped steel joists and rafters, in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Loadings:

Components shall be sized to withstand the design loads shown on the plans.

Wall system shall be designed to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclical day/night temperature range.

Wall system design shall accommodate construction tolerance, deflection of building structural members, and clearances of intended openings.

REFERENCES

Component Design: Structural properties of studs and joists shall be computed in accordance with American Iron and Steel Institute (AISI), "Specification for Design of Cold-Formed Steel Structural Members."

Welding:

Welding shall be in accordance with American Welding Society (AWS) D1.3, "Structural Welding Code - Sheet Steel."

Welders shall be qualified in accordance with "Welder Qualification," procedures of AWS D1.1, "Structural Welding Code-Steel."

SUBMITTALS

Product Data:

Manufacturer's descriptive data and installation instructions for each item of cold-formed metal framing and accessories shall be submitted for approval.

Installation instructions shall include instructions for securing studs to tracks and other framing connections.

Working Drawings:

Working drawings and calculations for cold formed metal framing components not fully dimensioned in manufacturer's descriptive data shall be submitted for approval.

Working drawings shall include framing members showing size and gage designations, number, type, location and spacing. Working drawings shall include supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

The cold formed metal framing supplier shall submit drawings and calculations stamped by an Engineer who is registered as a Civil or Structural Engineer in the State of California showing that the metal framing and fasteners comply with seismic and wind uplift requirements of the CBC.

QUALITY ASSURANCE

Fire-rated Assemblies: Where cold formed metal framing units are components of assemblies indicated to be fire-rated, provide units which have been approved for the rating indicated on the plans.

DELIVERY, STORAGE AND HANDLING

Cold formed metal framing components shall be protected from rusting and damage. Components shall be delivered to the jobsite in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Components shall be stored off ground in a dry ventilated space.

PART 2 - PRODUCTS

COLD FORMED METAL FRAMING

Steel Studs, Joists and Rafters:

Load-bearing studs shall be formed to channel shape, punched web, and knurled faces, conforming to ASTM Designation: A 653/A 653M, Grade 50 [340]. Studs shall be 16-gage minimum thickness and size as shown on the drawings.

Joists, rafters, and other framing components, 18-gage or lighter, shall be fabricated of commercial quality galvanized steel sheets; conforming to ASTM Designation: A 653/A 653M, Grade 33 [230].

Steel Track: Track shall be formed steel, channel shape, and same width as studs; solid web; not less than 18-gage thickness.

ACCESSORIES

Fasteners: Fasteners shall be hot-dipped galvanized, self-drilling, self-tapping screws, or bolts, nuts and washers.

Anchorages: Anchorages shall be ICBO approved for the purpose intended, integral stud type, powder driven or drilled expansion bolts.

FINISHES

Studs, Track and Headers: Studs, tracks and headers shall be hot-dipped galvanized to conform to ASTM Designation: A 653M, G60.

Miscellaneous Metal Parts: Miscellaneous parts, including, bracing, furring, plates, gussets, and bridging, shall be hot dipped galvanized to not less than 1¼ ounces per square foot.

FABRICATION

Cold formed metal framing components shall be fabricated in place or prefabricated into panels to the maximum extent possible prior to erection. Panels shall be fabricated plumb, square, true to line and braced against racking with joints welded. Lifting of prefabricated panels shall be performed in a manner to prevent damage or distortion.

Panels shall be fabricated in jig or templates to hold members in proper alignment and position to assure accurate placement.

Fastenings: Components shall be fastened by shop welding, bolting or screw fasteners as shown on the approved drawings.

PART 3 - EXECUTION

INSTALLATION

Studs:

Studs shall be erected plumb, except as needed for diagonal bracing or similar requirements. Channel tracks shall be aligned accurately to the wall layout at both floor and ceiling. Tracks shall be secured to floor and ceiling with fasteners spaced at not more than 16-inch intervals. Fasteners shall be provided at corners and ends of track.

Studs shall extend from floor to underside of ceiling except at wall openings. Each stud shall be secured to tracks at both top and bottom by bolting or screw fastening at both inside and outside flanges. Provide and install slotted clips as shown on drawings. Field welding shall not be permitted, unless otherwise shown on drawings. A ½-inch clearance shall be provided at the top shoes. Door openings shall have double studs continuous across head and from floor to ceiling on each jamb.

Studs at openings shall be fastened solidly and securely to floor clips. Floor clips shall be fastened to the floor with 2 anchors unless otherwise shown on the plans.

Supplemental framing, blocking and bracing shall be installed in steel stud system wherever walls or partitions are to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition.

One continuous, horizontal ¾-inch channel reinforcement shall be placed approximately 6 inches above all wall openings. The reinforcement shall pass through the web openings in the studs and shall extend through the first stud located beyond the double studs at either side of the opening and shall be saddle tied to each stud it passes through.

Joists and Rafters:

Joists and rafters shall be installed directly over bearing studs or a load distribution member shall be installed at the top track.

Web stiffeners shall be provided at reaction points where shown on the plans.

Ends of joists shall be reinforced with end clips, steel hangers, steel angle clips, steel stud section, or as otherwise recommended by the manufacturer.

Joists shall be secured to interior support systems to prevent lateral movement of bottom flanges.

12-5.05 BUILDING MISCELLANEOUS METAL

PART 1 - GENERAL

Scope: This work shall consist of fabricating, furnishing and installing building miscellaneous metal in accordance with the details shown on the plans and these special provisions.

Building miscellaneous metal shall consist of:

1. Drainage grates, steel gates, and access ladder fabrications.
2. Metal shapes required for general construction and not specified in other sections of the Special Provisions.
3. All anchors, fastenings, hardware, accessories and other supplementary parts necessary to complete the work.

REFERENCES

Codes and Standards: Welding of steel shall be in accordance with American Welding Society (AWS) D 1.1, "Structural Welding Code-Steel" and D 1.3, “Structural Welding Code-Sheet Steel.”

SUBMITTALS

Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications.

Working Drawings: Working drawings of fabricated items shall be submitted for approval.

QUALITY ASSURANCE

Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark all units for reassembly and installation.

Inspection and Tests: Materials and fabrication procedures shall be subject to inspection and tests by the Engineer, in mill, shop and field. Such tests will not relieve the Contractor of responsibility of providing materials and fabrication procedures in compliance with specified requirements.

PART 2 - PRODUCTS

MATERIALS

Steel Bars, Plates and Hot-rolled Shapes: Steel bars, plates and hot-rolled shapes shall conform to ASTM Designation: A 36/A 36M.

Galvanized Sheet Steel: Galvanized sheet steel shall conform to ASTM Designation: A 653/A 653M, Grade 33 [230]. Galvanizing shall be G60 [Z180].

Checkered Floor Plates: Checkered floor plates shall be commercial quality steel with standard raised pattern.

Pipe: Pipe shall be commercial quality standard steel pipe.

Steel Tubing: Steel tubing shall conform to ASTM Designation: A 500, Grade B

Bolts, Studs, Threaded Rods, Nuts and Washers:

Bolts, studs, threaded rods, and nuts for general application shall conform to ASTM Designation: A 307.

Washers shall be commercial quality.

Fittings: Brackets, bolt, threaded studs, nuts, washers, and other fittings for railings and handrailings shall be commercial quality pipe and fittings.

Expansion Anchors: Expansion anchors shall be ICBO approved for the purpose intended, integral stud type anchor or internally threaded type with independent stud, hex nut and washer.

Powder Driven Anchors: Powder driven anchors shall be plated, spring steel alloy drive pin or threaded stud type anchors for use in concrete or steel. Spring steel shall conform to ASTM Designation: A 227, Class 1. The diameter, length and type of shank and the number and type of washer shall be as recommended by the manufacturer for the types and thickness of material being anchored or fastened.

Resin Capsule Anchors: Stud anchors for resin capsule anchors shall conform to ASTM Designation: A 307 threaded steel rod with hex nut and washer and sealed glass capsule or cartridge containing an adhesive composed of unsaturated polyester resin and benzol peroxide coated quartz sand. Resin capsule shall be Hilti; Molly; or equal.

Drainage Grates:

1. Steel Grates: Drainage grates shall be fabricated from steel bars as specified herein; ductile iron castings conforming to ASTM Designation: A 536, Grade 65-45-12; or carbon steel castings conforming to ASTM Designation: A 27, Grade 65-35.

Public Courtyard Grates: Linear grate system fabricated from extruded aluminum (ASTM B221) with 20 gage stainless steel ASTM A 666 trench liner.

a. Fabricate trench grating trench bars spaced 1/2 inch o.c. with maximum space between bars a 1/4 inch. Provide concealed locking mechanisms.
b. Allowable load: 300 pounds.

Mortar: Mortar shall consist of one part cement, measured by volume, to 2 parts clean sand and only enough water to permit placing and packing.

Steel fence, gates and accessories shall be fabricated from steel bars, tubes, plates, tubes, and hot rolled shapes. Hot-dip galvanize and paint. Prepare hot dip galvanizing in accordance with American Galvanizers Association "Suggested Specification for Preparing Hot-Dip Galvanized Steel Surfaces for Painting". Prime and paint per Section 12-9.

Fixed ladder to roof hatch shall be a heavy duty aluminum channel rail fixed access ladder. Rungs shall be capable of supporting 1,500 pound load or greater. Provide wall brackets, floor brackets, and safety post. Rungs shall be serrated. Aluminum shall be 6063 alloy.

FABRICATION

Workmanship and Finish:

Workmanship and finish shall be equal to the best general practice in modern shops.

Miscellaneous metal shall be clean and free from loose mill scale, flake rust and rust pitting, and shall be well formed and finished to shape and size with sharp lines and angles. Bends from shearing or punching shall be straightened.

The thickness of metal and details of assembly and support shall give ample strength and stiffness.

Built-up parts shall be true to line and without sharp bends, twists and kinks. Exposed ends and edges of metal shall be milled or ground smooth, with corners slightly rounded.

Joints exposed to the weather shall be made up to exclude water.

Galvanizing: Items indicated on the plans to be galvanized shall be hot-dip galvanized after fabrication. The weight of galvanized coating shall be at least 1½ ounces per square foot of surface area, except drainage grates shall have at least 2 ounces per square foot of surface area.

Painting: Building miscellaneous metal items not galvanized , or designated to be galvanized and painted, shall be cleaned and prime painted prior to erection in accordance with the requirements specified for steel and other ferrous metals under "Painting" in Section 12-9, "Finishes," of these special provisions.

Loose Bearing and Leveling Plates: Loose bearing and leveling plates shall be furnished for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Plates shall be drilled to receive anchor bolts. Galvanize after fabrication.

Drainage Pipes, Frames and Grates:

Drain piping shall have connections sealed watertight.

Drainage grates shall have end bars of the same cross section as support bars. Connections between end bars and support bars of structural steel shall be welded all around.

Drainage frames shall be angles and plates as shown on the plans.

Drainage grates and frames shall be match marked.

PART 3 - EXECUTION

GENERAL

Anchorages:

Anchorage devices and fasteners shall be provided for securing miscellaneous metal in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws and other connectors.

Cutting, drilling and fitting shall be performed as required for installation of miscellaneous metal fabrications. Work is to set accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

Loose Leveling and Bearing Plates: Plates shall be set on wedges or other adjustable devices. Anchor bolts shall be wrench tightened after the plates have been positioned and plumbed. Mortar shall be packed solidly between bearing surfaces and plates to ensure that no voids remain.

Powder Driven Anchors: Powder driven anchors shall be installed with low velocity powder actuated equipment in accordance with the manufacturer's instructions and State and Federal OSHA regulations.

Resin Capsule Anchors: Resin capsule anchors shall be installed in accordance with the manufacturer's instructions.

DAMAGED SURFACES

Galvanized surfaces that are abraded or damaged at any time after the application of the zinc coating shall be repaired by thoroughly wire brushing the damaged areas and removing all loose and cracked coating, after which the clean areas shall be painted with 2 applications of unthinned zinc-rich primer (organic vehicle type). Aerosol cans shall not be used.

12-5.06 STAINLESS STEEL HANDRAIL AND RAILINGS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of fabricating, furnishing and installing stainless steel handrails and railing systems in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data for products and processes used in handrails and railing systems shall be submitted for approval.

Working Drawings:

Working drawings of handrails and railings shall be submitted for approval.

Working drawings shall show fabrication and installation for each type of handrail and railing system required including plans, elevations, sections, profiles of rails, fittings, connections and anchors.

Samples: Three 6-inch long samples of each distinctly different railing member, including handrails, top rails, posts and balusters, shall be submitted for approval.

QUALITY ASSURANCE

Single Source Responsibility: Handrails and railing systems of each type and material shall be obtained from a single manufacturer.

Mock-Ups: Mock-Ups: Install at project site or appropriate location a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Engineer's approval of product, application, and workmanship standards.

1. Mock-Up Size: 36 inch minimum length complete with top and intermediate rails, posts and base..

2. Maintenance and Disposal: Maintain mock-up during construction for workmanship comparison.

a) Removal: Remove and legally dispose of mock-up when no longer required.
b) Incorporation: Mock-up may be incorporated into final construction upon Engineer'sapproval.

DELIVERY, STORAGE AND HANDLING

Storage: Handrails and railing systems shall be stored in clean, dry location, away from uncured concrete and masonry, protected from damage of any kind. Handrails and railing systems shall be covered with waterproof paper, tarpaulin, or polyethylene sheeting. Allow for air circulation.

PART 2 - PRODUCTS

MATERIALS

Railing Elements: Railing elements shall be type 304 stainless steel with a No. 4 satin brushed finish. Tube shall be 1-1/2" diameter ornamental grade with yield strength of 55,000 psi or greater. Wall thickness shall be designed by fabricator to meet or exceed industry standard for handrail strength, durability, and deflection criteria. Minimum wall thickness shall be schedule 5.

Brackets, Flanges, Fittings and Anchors: Brackets, flanges, fittings and anchors shall be the manufacturer's standard for interconnection of handrail and railing members to other work.

Fasteners:

Fasteners shall be the same basic metal as the fastened metal. Corrosive metals and metals that are incompatible with the metals joined shall not be used.

Concealed fasteners shall be used for interconnections of handrail and railing components and for their attachments to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing systems indicated.

Exposed fasteners shall be Phillips flat head screws unless otherwise noted on the plans.

FABRICATION

Handrails and railing systems shall be fabricated to the dimensions and details shown on the plans.

Items shall be preassembled in the shop to the greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for shipping and handling.

Returns shall be made at free ends of handrailing to bring the pipe to within ¼ inch of the wall. Ends of railing elements shall be capped. Concealed weeps shall be provided at low points.

Expansion joints shall have pipe sleeves.

Changes in direction of railing members shall be formed by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering. Elbow bends shall be by using radius joints.

Welding shall be by the tungsten inert gas arc welding method or the consumable electrode inert gas method. Welding processes that require the use of flux will not be permitted.

All welds shall conform to the requirements of Section 8.15, "Quality of Welds," of the American Welding Society publication No. AWS D 1.1, "Structural Welding Code."

Exposed welds shall be ground smooth and flush.

FINISHES

Provide No. 4 satin brush finish. Surfaces shall be free of scratches, porosity, inclusions, roll and die marks, cold-shuts, and cracks that will adversely affect the appearance and performance.

PART 3 - EXECUTION

INSTALLATION

The handrailing shall be erected to line and grade without welding in the field. Installation shall be in accordance with the manufacturer's recommendations. Posts shall be within 1/8 inch of vertical.

Exposed connections shall be accurately fitted to form tight, hairline joints.

The location of expansion joints shall be in accordance with the manufacturer's recommendation except that joints shall be spaced not closer than 15 feet apart and shall be coordinated with joint locations in the support structure.

Corrosion Protections:

An isolation coating or insulator shall be provided on stainless steelsurfaces in contact with dissimilar metals.

Railing Connections:

Railing ends shall be anchored to concrete or masonry with manufacturer’s standard fittings designed for this purpose, unless otherwise shown on the plans.

Handrails shall be secured to walls with the manufacturer’s standard wall brackets and fittings, unless otherwise shown on the plans.

CLEANING

Paint, dirt, stains and grout shall be removed without marring or scratching the surfaces. Solvents and cleaning compounds shall be chemically compatible with stainless steel and the finish.

PROTECTION

Finishes of railing systems and handrails shall be protected from damage during constructions by use of temporary protective coverings. Coverings are to be removed upon completion of the work.

Finishes damaged during installation and construction shall be restored so that no evidence remains of construction work.

12-5.07 STAIR NOSING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing stair nosings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Sample: Provide a 6 inch long sample.

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturers: Subject to these special provisions, acceptable manufacturers shall be American Safety Tread Co., Inc., Model No. 801, Safety yellow color; Barry Pattern & Foundry Co, Model No. B1-SP; Wooster Products Inc., Model No. 101, Safety yellow color; or equal.

MATERIALS

Stair Nosing:

Stair nosing: factory fabricated units made of heavy duty, cast iron. Paint: manufacturer’s standard primer, and safety yellow.

Stair nosing shall meet OSHA requirements for anti-slip safety on stairs.

The base anchor system shall stabilize the nosing, prevent rocking and loosening, and shall permanently lock the nosing into place.

Wing Type Anchors: 18-8 stainless steel, countersunk fasteners.

PART 3 - EXECUTION

INSTALLATION

The stair nosing shall be securely installed to prevent rocking or other movement during placing of concrete. Use protective tape to keep treads free of dirt during constr

SECTION 12-6. WOOD AND PLASTIC

12-6.01 ROUGH CARPENTRY

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing materials and performing rough carpentry work including wood framing, furring, and sheathing in accordance with the details shown on the plans and these special provisions.

Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed.

SUBMITTALS

Product Data: Manufacturer's material data and installation instructions shall be submitted for gypsum sheathing, framing hardware and underlayments.

Wood Treatment Data:

Chemical treatment manufacturer's instructions shall be submitted for the handling, sorting, installation, and finishing of treated materials.

For each type of preservative treatment used, certification by treating plant shall include type of preservative solution and pressure process used, net amount of preservative retained and conformance with the applicable standards of the American Wood Preservers Association.

DELIVERY, HANDLING AND STORAGE

Delivery and Storage: Materials shall be kept under cover and dry. All materials shall be protected from exposure to weather and contact with damp or wet surfaces with blocking and stickers. All lumber, plywood and other panels shall be stacked in such a manner to provide air circulation within and around the stacks.

PART 2 - PRODUCTS

LUMBER

Lumber shall be manufactured to comply with PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection.

Softwood lumber shall be quality grade stamped or shall be accompanied by a certificate of inspection. Inspection certificates or grade stamps shall indicate compliance with the grading requirements of WWPA, WCLIB, RIS, or other approved lumber inspection agencies.

All lumber used shall be nominal sized and dressed S4S unless otherwise specified in these special provisions.

DIMENSION LUMBER

Miscellaneous Lumber:

Miscellaneous lumber for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members shall be not less than No. 2 or better.

Lumber in contact with concrete or masonry construction shall be pressure treated Douglas Fir-Larch.

PLYWOOD PANELS

Plywoodpanels shall comply with Voluntary Product Standard PS1, "U. S. Product Standard for Construction and Industrial Plywood."

Plywood panels shall be Group 1 unless otherwise noted.

Each plywood panel shall be factory marked with APA or other trademark evidencing compliance with grade requirements.

Structural Plywood Wall Sheathing: Structural plywood wall sheathing for walls shall be APA RATED SHEATHING, Exposure 1. Thickness and grade shall be as shown on the plans.

Structural Plywood Roof Sheathing:

Structure plywood roof sheathing shall be APA RATED SHEATHING, Exposure 1. Span rating, thickness and grade shall be as shown on the plans.

Structure plywood roof sheathing in exposed overhangs shall be APA RATED SHEATHING, A-C, Exterior, Group 1. Thickness shall be the same as the remainder of the sheathing.

Plywood Decking: Plywood decking shall be APA RATED STURD-I-FLOOR, Exposure 1, with tongue-and-groove edges. Span rating and thickness shall be as shown on the plans.

ROOF SHEATHING

Roof sheathing: Securock roof board or approved equal, impact-resistant non-structural fiber reinforced gypsum panels made from 95% recycled materials, and be moisture and mold resistant throughout the panel core and surface. When tested in accordance with ASTM E84 Flamespread shall be 5 and smoke developed 0. Roof sheathing shall be Class A when tested in accordance with UL 780. Surface water absorption per ASTM C473 shall be less than or equal to 1.6 grams nominal. Water resistance shall be 10% maximum weight gain per ASTM C472. Mold resistance rating per ASTM D3273 shall be 10.

MISCELLANEOUS MATERIALS

Expansion anchors and powder driven anchors shall be as specified under "Building Miscellaneous Metal," in Section 12-5, "Metals," of these special provisions.

Nails: Nails shall conform to ASTM F 1667-95. "Common" nails shall conform to the following table:

Nail Size	Length (inches)	Diameter (inches)
8d	2½	0.131
10d	3	0.148
16d	3½	0.162

WOOD TREATMENT BY PRESSURE PROCESS

Preservative Treatment:

Preservative treatment shall be copper napthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

The following items shall be treated:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

Wood sills, sleepers, blocking, furring and other similar members in contact with concrete or masonry.

All holes, daps and cut ends of treated lumber shall be thoroughly swabbed with 2 applications of copper napthenate.

PART 3 - EXECUTION

INSTALLATION

Plywood Panels:

Plywood panels shall be attached to the framing as shown on the plans and these special provisions. All structural plywood sheathing (both roof and wall) shall be nailed with "Common" nails.

Plywood decking shall be glued and nailed to the framing system.

Plywood sheathing shall be nailed to the framing system and shall be continuous over 2 or more supports. Roof and floor panels shall be installed with the long dimension across the supports, with end joints staggered 4 feet. Wall sheathing shall have all edges blocked. Spacing between panels shall be 1/8 inch.

Roof Sheathing

Roof sheathing shall use maximum lengths possible to minimize joints. Provide edge joints with deck ribs. Stagger adjacent lengths. Use minimum ½" thickness roof board for vertical wall applications.

12-6.02 FINISH CARPENTRY

PART 1 - GENERAL

SUMMARY

Scope: This work consists of furnishing and installing materials and performing finish carpentry, including exterior and interior trim,and plywood and softwood paneling, as shown on the plans and these special provisions.

Finish carpentry includes carpentry work not specified as part of other sections and which is generally exposed to view.

SUBMITTALS

Product Data: Manufacturer's specifications and installation instructions for each item of factory-fabricated siding and paneling.

SamplesThreesamples shall be submitted to the Engineer at the jobsite for each species and cut or pattern of finish carpentry as shown below:

Interior standing and running trim: 2 feet long by full board or molding width, finished on one side and one edge.

Plywood paneling: 2 feet long x full panel width, finished on one side.

QUALITY ASSURANCE

Factory Marks: Each piece of lumber and plywood shall be marked with type, grade, mill and grading agency identification. Marks shall be omitted from surfaces to receive transparent finish. A mill certificate stating that material has been inspected and graded in accordance with requirements shall be furnished if marks cannot be placed on concealed surfaces.

PRODUCT DELIVERY, STORAGE AND HANDLING

Delivery: Carpentry materials shall be delivered after painting, wet work and similar operations have been completed.

Protection: Finish carpentry materials shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2 - PRODUCTS

WOOD PRODUCT QUALITY STANDARDS

Softwood Lumber: Softwood lumber shall conform to the requirements of PS 20, "American Softwood Lumber Standard," with applicable grading rules of inspection.

Plywood: Plywood shall conform to the requirements of Voluntary Products Standard PS-1, "U. S. Product Standard for Construction and Industrial Plywood."

Woodworking: Woodworking shall conform to the requirements of Woodwork Institute of California (WIC), "Manual of Millwork."

MATERIALS

Lumber sizes indicated shall be nominal sizes except as indicated by detailed dimensions. Lumber which is to be dressed or worked and dressed shall be manufactured to the actual sizes as required by PS 20.

Lumber that is to be painted may be solid or glued-up lumber at the contractor's option.

Glued-up lumber for exterior finish work shall comply with PS 56 for "wet use" and be so certified by the inspection agency.

Plywood Mounting Panels: Mounting panels for electrical and communication equipment shall be ¾ inch plywood; APA C-D plugged; exposure 1, touch sanded and back primed before installation.
Interior Standing and Running Trim:

Standing and running trim to be painted shall be paint-grade pine, solid stock or finger jointed.

Miscellaneous Materials:

Nails, screws and other anchoring devices of the type, size, material and finish required shall be provided for secure attachment, concealed where possible.

Fasteners and anchorages for exterior use shall be hot dip galvanized.

Screens for soffit vents shall be 4 x 4 or 8 x 8 mesh, galvanized screen. Open area shall be not less than 50 percent.

Preservative Treatment:

Preservative treatment shall be copper napthenate, pentachlorophenol or water-borne arsenicals (ACA, CCA or ACZA).

Wood members, except those of redwood, in contact with mortar setting beds, concrete block walls, slab on grade and other concrete work, and wood used for roofing cant and curbs shall be pressure treated with leach resistant preservative. Each piece of pressure treated lumber shall bear the AWPA label.

All holes, daps, or cuts made after treating shall be thoroughly swabbed with copper napthenate

Fire Retardant Treatment: Fire retardant treatment shall be paintable, odorless fire retardant preservative applied by pressure treating methods.

PART 3 - EXECUTION

INSTALLATION

All work shall be installed plumb, level and true with no distortions.

Standing and Running Trim:

Standing and running trim shall be installed with minimum number of joints possible, using full length pieces to the greatest extent possible.

Anchor Finish Carpentry:

Finish carpentry shall be anchored to framing or blocking built in or attached directly to the substrate.

Interior carpentry shall be attached to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing where required for complete installation. Fine finish nails shall be used for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent finish is indicated.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

Damaged and defective finish carpentry work shall be repaired or replaced.

All exposed or semi-exposed surfaces shall be cleaned.

Finish carpentry shall be finished in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-6.03 WOOD CABINETS

PART 1.- GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing wood cabinets and plastic laminate tops, splashes and returns including tops, ledges, supporting structures, filler panels, knee space panels, and scribes as shown on the plans and in these special provisions.

RELATED SECTIONS

Steel laboratory cabinets shall conform to the requirements under “Steel Laboratory Casework” in Section 12-12.02 “Furnishings,” of these special provisions.

SUBMITTALS

Product data: Manufacturer's product data for plastic laminates and cabinet hardware shall be submitted for approval.

Samples:--Five samples shall be submitted for each of the items shown below:

Plastic laminate: 12 in x 12 in for each type, color, pattern and surface finish.

Molded epoxy resin: 10 in x 12 in for each type, color, pattern and surface finish.

Countertop support bracket

Edge molding: standard manufacturer’s color and sample palette.

Working drawings: Working drawings for cabinets showing location of cabinets, dimensioned plans and elevations, attachment devices and other components shall be submitted for approval. Working drawings shall bear the "WIC Certified Compliance Label" on the first sheet of the drawings. Provide roughing in drawings for mechanical and electrical services where required.

CERTIFICATE OF COMPLIANCE

Certificates of Compliance: Prior to delivery to the jobsite, the cabinet manufacturer shall issue a WIC Certified Compliance Certificate indicating that the products he will furnish for this job and certifying that they will fully meet all the requirements of the grade or grades specified.

QUALITY ASSURANCE

Codes and standards: Cabinets and swinging gate shall be manufactured and installed in accordance with the Manual of Millwork of the Woodwork Institute of California (WIC) requirements for the grade or grades specified or shown on the plans.

WIC Certified Compliance Label : shall be stamped on all cabinet work. Each plastic laminate top shall bear the WIC Certified Compliance Label. Prior to completion of the contract, a WIC Certified Compliance Certificate for Installation shall be delivered to the Engineer.

Samples: Furnish a full size base and wall cabinet showing actual construction and materials to be used including counter tops..

1. Deliver samples to the site.

2. Acceptable samples may be incorporated into the Work.

DELIVERY, STORAGE AND HANDLING

Protection: Cabinets shall be protected during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

PART 2.-PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturers: Subject to compliance with these specifications, high pressure decorative laminates shall be Consoweld Corp.; Formica Corp.; Nevamar Corp.; or equal.

MANUFACTURED UNITS

General: Cabinets shall be fabricated to the dimensions, profiles, and details shown on the plans with openings and mortises precut, where possible to receive hardware and other items and work. Fabrication, assembly, finishing, hardware application, and other work shall be completed to the maximum extent possible prior to shipment to the jobsite.

Laminate clad cabinets :

Laminate clad cabinets shall be custom grade, flush overlay construction. Laminate cladding shall be high pressure decorative laminate complying with NEMA LD 3. Color, pattern and finish shall be as shown on the plans. Laminate surface and grade shall be as follows:

Horizontal and vertical surfaces other than tops shall conform to GP-50 (1.27 mm nominal thickness).

Post formed surfaces shall conform to PF-42 (1.07 mm nominal thickness).

Laminated counter tops and splashes:

Laminated counter tops and splashes shall be WIC custom grade. Surface material shall be high pressure laminated plastic conforming to NEMA LD-3, 1.27 mm thickness. Unless otherwise shown on the plans, splashes shall be 4 in high from the surface of the deck. Back splashes shall be continuous formed and coved. Side splashes shall be top set. Laminated counter tops self edged, counter tops to receive sinks or plumbing fixtures shall have a bullnose.

The underside of tops and backsides of splashes shall be covered with an approved backing sheet.

Moulded epoxy resin tops: Epoxy resin tops shall be heavy duty laboratory type epoxy compounded and cured to provide optimum physical and chemical resistance properties. Epoxy resin tops and curbs shall be uniform mixture through full thickness. Tops and curbs shall be non-glaring and bonded to form a water tight joint.

Stainless steel countertop: 16 gauge, 304 stainless steel, sound deadening, No. 4 satin finish.

CABINET HARDWARE AND ACCESSORY MATERIALS

General: Cabinet hardware and accessory materials shall be provided for cabinets. Hardware shall be provided with standard US 32D metal plated finish, unless noted otherwise on plans.

Drawer slides: Drawer slides shall be side mounting full extension with fully enclosed rolling balls and rollers. Concealed slides and bearings, and positive stop. Capacity shall be not less than 75 lb, except capacity shall be not less than 100 lb for heavy duty drawers.

Door guides: Sliding door guides shall be continuous, dual channel, metal guides, top and bottom. Bottom guide shall have crowned track.

Shelf supports: Shelf supports shall be adjustable, semi-recessed, chrome finished pressed metal, heavy duty standards and support clip, with one inch adjustment increments.

Cabinet hinges: Cabinet hinges shall be steel concealed European style with vertical and horizontal adjustment, one hinge per door shall be self closing.

Cabinet pulls: Cabinet pulls shall be 3/8 inch dia approximately 4" x 1-1/2" long approximately 3/8 inch offset, stainless steel satin finish.

Cabinet suspension fittings: Cabinet suspension fittings shall be made of macrolon and have releases which do not require tools. Cabinet suspension fittings shall be manufactured by Hafele, Model Keku Suspension Fittings P.A.S. or approved equal. Suspension fittings shall be used on removable access panels including all kitchen ADA panels at countertop sinks.

Cable Grommets: Cable grommets shall be two piece sets, 2-3/8 in diameter round, with spring closure. Provide grommets for all cables. Cable grommets shall be black plastic manufactured by Hafele, Model 429.99.324 or approved equal.

Edge molding: Elastomer urethane continuous seamless molding, 75 Shore A Durometer, cross section configuration as shown on plans, semi-soft to accommodate radiused or mitered corner conditions, stain resistant, UV stable, self extinguishing flame retardant, tongue and grove installation with epoxy adhesive, Edge mould products, T-Edge bull nose.

Countertop support bracket: Prefinished steel welded construction, predrilled mounting holes for both table top and wall mounting, 1100 pound load capacity per pair.

Lavatory protective enclosure: ADA compliant under sink lavatory protective enclosure, protection for wheelchair accessibility, single piece, rigid high impact resistant PVC, nominal wall 0.093", UL listed.

FABRICATION

Shop assembly: Nails shall be countersunk and the holes filled, molds shall be neatly mitered and all joints shall be tight and true. As far as practicable, work shall be assembled at the mill and delivered to the building ready to be set in place. Parts shall be smoothly dressed and interior work shall be belt sanded at the mill and hand sanded at the building. After assembly, work shall be cleaned and made ready for the specified finish. All work shall be prepared to receive finish hardware. Finish hardware shall be accurately fitted and securely fastened as recommended by the manufacturer. Finish hardware shall not be fastened with adhesives. Drawers shall be fitted with dust covers of 6 mm plywood or hardboard above compartments and drawers except where located directly under tops.

Precut openings: Openings for hardware, appliances, plumbing fixtures, and similar items shall be precut where possible. Openings shall be accurately located and templates used for proper size and shape. Edges of cutouts shall be smoothed and edges sealed with a water-resistant coating.

PART 3.- EXECUTION

INSTALLATION

Cabinets: Cabinets shall be installed without distortion so that doors and drawers fit openings properly and are accurately aligned. Hardware shall be adjusted to center doors and drawers in openings and to provide unencumbered operation. Installation of hardware and accessory items shall be completed as indicated on the approved drawings.

Laminate tops: Laminate tops shall be securely fastened to base units and other support systems as indicated on the approved drawings.

Cabinet hardware: Doors for cabinets shall be equipped with one pair of hinges and one catch per leaf, unless otherwise shown on the plans. Each door leaf shall be equipped with one pull.

Drawers up to 12 in wide shall have one pull and drawers over 12 in wide shall have two pulls.

Blocking shall be provided in the wall between wall framing as necessary to anchor cabinet supports.

SECTION 12-7 THERMAL AND MOISTURE PROTECTION

12-7.01 WATER REPELLENT COATING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying water repellent coating to concrete or masonry surfaces.
The water repellent coating shall be applied to all exterior vertical concrete or masonry surfaces and exposed aggregate surfaces as shown on the plans.

SUBMITTALS

Product Data: Manufacturer's descriptive data, application instructions and general recommendations for water repellents shall be submitted for approval.

QUALITY ASSURANCE

Codes and Standards: Water repellent coatings shall comply with all rules and regulations concerning air pollution in the State of California.

Certificates of Compliance: Certificates of Compliance shall be furnished with each shipment of water repellent coating materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

PART 2 - PRODUCTS

Water Repellent Coating: Water repellent coating shall be clear, colorless, water-based sealer. Water repellent coating shall be Hydrozo Inc., Clear Double 7; Euclid Chemical Co., Architectural Seal VOX; Tamms Industries Co., Chemstop; or equal.

PART 3 - EXECUTION

Preparation: All surfaces to receive water repellent coating shall be dry and cleaned by removing contaminants that block pores of the surface. Cleaning methods shall be as recommended by the water repellent manufacturer.

Application:

The water repellent solution shall be applied in accordance with the manufacturer's printed instructions

The time period between applications of water repellent coating shall be not less than 24 hours.

Protection: Surfaces of other materials surrounding or near the surfaces to receive the water repellent coating shall be protected from overspray or spillage from the waterproofing operation. Water repellent coating applied to surfaces not intended to be waterproofed shall be removed and the surfaces restored to their original condition.

12-7.02 BITUMINOUS WATERPROOFING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying a bituminous waterproofing membrane in accordance with the details shown on the plans and these special provisions.

Bituminous waterproofing membrane shall consist of a coating of primer, a bonded, continuous membrane composed of 2 layers of asphalt saturated glass fabric and 3 moppings of waterproofing asphalt.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and recommendations for each waterproofing material shall be submitted for approval.

QUALITY ASSURANCE

The Contractor shall obtain primary materials from a single manufacturer. Secondary materials shall be only as recommended by the primary manufacturer.

Labels: Materials shall be furnished which have factory applied labels affixed to each container or roll of material certifying compliance with ASTM standards specified.

PART 2 - PRODUCTS

Asphalt Primer: Asphalt primer shall be cut-back type conforming to ASTM Designation: D 41.

Waterproofing Asphalt: Waterproofing asphalt shall conform to ASTM Designation: D 449, Type I, suitable for vertical surfaces below grade.

Glass Fiber Fabric: Glass fiber fabric shall conform to ASTM Designation: D 1668, Type I, for woven glass fabric treated with asphalt and weighs about 1.5 pounds per 100 square feet.

Plastic Cement: Plastic cement shall be suitable for use with bituminous materials.

Protection Board: Protection board shall be organic fiberboard treated for resistance to fungus and insects, asphalt impregnated and asphalt coated on both faces; ½ inch thick unless otherwise noted.

PART 3 - EXECUTION

PREPARATION

Protection: Liquid or mastic compounds shall not be permitted to enter or clog drains and conductors. Spillage or migration onto other surfaces of work shall be prevented by masking or otherwise protect adjoining work.

Surface Preparation: All concrete surfaces which are to be waterproofed shall be reasonably smooth and free from holes and projections which might puncture the membrane. The surface shall be dry and thoroughly cleaned of dust and loose materials.

The primer shall be applied to the surface and allowed to dry before applying asphalt.

INSTALLATION

Installation shall comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where proper conditions require extra precautions or provisions to ensure satisfactory performance of work.

Application:

No primer or asphalt shall be applied in wet weather, nor when the temperature is below 65°F. Heating shall be in accordance with the manufacturer's instructions.

Multiply-courses of bitumen and felts or fabrics shall be installed in individual courses, unless manufacturer recommends shingle-fashion courses. Courses shall be laid in direction or directions recommended.

Membrane shall be extended as flashing at edges, openings and projections, so as to complete waterproof enclosure as required for leakproof installation.

Protection Board: Protection board shall be set into last course of asphalt before it cools.

12-7.03 INSULATION (GENERAL)

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing insulation in accordance with the details shown on the plans and these special provisions.

Insulation materials shall be as specified in these special provisions, and shall be compatible with existing or new materials incorporated in the building.

SUBMITTALS

Product Data:

A list of materials, manufacturer's descriptive data, location schedule, and time schedule shall be submitted for approval.

The list of materials to be used shall include the trade name, manufacturer's name, smoke developed and flame spread classification, resistance rating and thickness for the insulation materials and accessories.

Schedules:

A location schedule and time schedule shall be submitted for approval.

The location schedule shall show where each material is to be installed.

The Contractor shall provide the Engineer at the jobsite with an accurate time schedule of the areas of the building to be insulated each day. The time schedule shall be submitted 3 working days in advance of the work.

Samples: Samples of each type of insulation material for approval.

QUALITY ASSURANCE

Codes and Standards: All insulating materials shall be certified to comply with the California Quality Standards for Insulating Materials and shall be listed in the Department of Consumer Affairs publication "Consumer Guide and Directory of Certified Insulation Material."

DELIVERY, STORAGE AND HANDLING

Insulating materials shall be delivered to the jobsite and stored in a safe dry location with labels intact and legible.

Insulating materials shall be protected from physical damage and from becoming wet or soiled.

In the event of damage, materials shall be repaired or replaced as necessary to comply with these specifications.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

12-7.04 BATT AND BLANKET INSULATION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing batt or blanket insulation in accordance with the details shown on the plans and these special provisions.

Batt insulation shall include faced and unfaced batts in walls and ceilings, acoustical batts for sound control and exposed batt or blanket insulation for ceilings and walls.

QUALITY ASSURANCE

Laminator's Qualifications:

Laminator for bonding polyethylene vapor-retarder to insulating batts shall be approved by the insulation manufacturer.

The name of the laminator shall be submitted with the Product Data.

Codes and Standards:

All batt or blanket insulation, including facings such as vapor barriers, shall have a flame-spread rating not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 8-1.

The flame-spread and smoke density limitations do not apply to facings on batt insulation installed between ceiling joists, or in roof-ceiling or wall cavities, provided the facing is installed in substantial contact with the surface of the ceiling or wall finish.

PART 2 – PRODUCTS

INSULATING MATERIALS

Fiberglass batts shall be thermal insulation produced by combining glass fibers with thermosetting resins to comply with ASTM Designation: C 665.

Wall Insulation: Wall insulation shall be R-19 fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C; R value as indicated on the plans.

Ceiling Insulation: Ceiling insulation shall be R-30 fiberglass batts with paper-laminate vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665, Type II, Class C.

Acoustical Insulation: Acoustical insulation shall be 3½ inches, unfaced fiberglass insulation batts. Insulation shall conform to ASTM Designation: C 665, Type I.

Exposed Insulation:

Exposed insulation shall be fiberglass batts with bonded polyethylene vapor-retarder membrane on one face. Insulation shall conform to ASTM Designation: C 665. Type I. Exposed insulation for ceilings shall be R-30 and R-19 for walls.

VAPOR-RETARDERS

Paper-laminate Vapor-retarder: Paper-laminate vapor-retarder shall be kraft paper sheets laminated together with asphalt or other vapor retarding compounds, scrim reinforced at edges of sheets.

Polyethylene Vapor-retarder: Polyethylene vapor-retarder shall be factory-applied, 3 mils, white polyethylene film, a blend of fiberglass and polyester yarn reinforcement, and metallized polyester film laminated with a flame resistant adhesive, and a Class I flame-spread classification.

AUXILIARY INSULATION MATERIALS

Insulation Tape: Insulation tape shall be as recommended by the insulation manufacturer.

Insulation Adhesive: Insulation adhesive shall be the type recommended by the insulation manufacturer and complying with the requirements for fire resistance.

FABRICATION

Polyethylene shall be factory laminated to fiberglass batts or blankets by an applicator approved by the manufacturer of the batts or blankets.

PART 3 - EXECUTION

INSTALLATION

The vapor retarder on faced batts shall be toward the interior and shall be fastened to provide a sealed retarder. Punctures and holes in the retarder shall be repaired.

Unless otherwise shown on the plans or specified elsewhere in these special provisions, insulation shall be kept at minimum 3 inches clear of lighting fixtures and heat producing electrical appliances and equipment.

Installing Batt Type Insulation: Insulation batts shall be installed to completely fill the space between framing members. Apply a single layer of insulation of required thickness, unless otherwise shown on the plans or required to make up total thickness. Installation shall conform to the manufacturer's recommendations and these special provisions.

Installing Exposed Insulation:

Insulation shall be installed to the underside of metal roofing in attic spaces with stick clips and adhesive as required to provide a blanket membrane without sags. If sagging occurs, provide No. 10 or No. 12 wire, tautly installed, to help hold insulation in place and to keep insulation from sagging.

Joints in exposed insulation shall be sealed by lapping not less than 4 inches. Exposed insulation shall be fastened to framing at top, end and bottom, at perimeter of wall openings and at lap joints.

Overlapping joints shall be sealed with insulation adhesives as recommended by vapor retarder manufacturer's printed directions. Butt joints and fastener penetrations shall be sealed with insulation tape of the type recommended by the vapor retarder manufacturer. Joints at pipes, conduits, electrical boxes and similar items penetrating the vapor retarder shall be sealed.

12-7.05 THROUGH-PENETRATION FIRESTOPPING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing firestopping materials at penetrations in fire-rated walls, floors, and ceilings in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data:

A list of materials, manufacturer's descriptive data, and location schedule shall be submitted for approval.

Descriptive data shall include trade names, manufacturers' names, complete information on the materials to be applied, California State Fire Marshal Listing, the material thickness for the required fire resistance ratings, and the manufacturer's printed instructions for installation. Manufacturer's assembly shall be California State Fire Marshal approved.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of Compliance shall be furnished with each shipment of firestopping materials in accordance with Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING

Delivery: Materials to be applied shall be delivered in original unopened packages. Packages shall be identified by the manufacturer's label and shall bear proper labels for fire resistance classification.

Storage: Materials shall be stored above ground, under cover, and in a dry location until ready for use. Packages which have been exposed to moisture before use shall be discarded.

PART 2 - PRODUCTS

Fire-rated Caulk: Fire-rated caulk shall conform to ASTM Designation: E 814 and shall be rated for use in 2 and 3-hour fire-rated assemblies. Fire-rated caulk shall be 3M Brand, Fire Barrier Caulk; Dow Corning, Fire Stop Sealant; Standard Oil, Fyre Putty; or equal.

Wrap Strip: Wrap strip shall be nominal ¼-inch thick intumescent elastomeric material in 2-inch wide strips, faced one side with aluminum foil, and rated for use in 1-hour and 2-hour fire-rated systems.

Packing Material: Packing material shall be polyethylene backer rod or nominal one-inch thickness of tightly packed ceramic (alumina silica) fiber blanket, mineral-wool batt or glass fiber insulation material.

Fire-rated Mortar: Fire-rated mortar shall be non-asbestos, 47 to 57 pounds per cubic foot air dried density portland cement fly ash through-penetration firestopping mortar. Fire-rated mortar shall conform to ASTM Designation: E 814 and shall be rated for use in 3-hour fire-rated systems at 3-inch minimum thickness.

Fire Safing Insulation: Fire safing insulation shall be inorganic 3.5 pounds per cubic foot minimum density, non-combustible fiber insulation conforming to Federal Specifications HH-1-521F, when tested in accordance with ASTM Designation: E 119 and ASTM Designation: E 136 for 3 hour fire resistance.

PART 3 -EXECUTION

Installation: Firestopping materials shall be installed to conform to the requirements of the California State Fire Marshal Listing and the manufacturer's recommendations.

12-7.06 INTUMESCENT FIREPROOFING

PART 1 GENERAL

SUMMARY

Scope: This work consists of the requirements for epoxy-based intumescent fireproofing for building structures.

SYSTEM DESCRIPTION

System includes one hour and two hour fire-rated protection for structural steel members as indicated. Fireproofing material shall be an epoxy-based intumescent fireproof coating. Provide decorative topcoat for exposed portions of structural steel only.

REFERENCES

American Society for Testing and Materials (ASTM):

1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials

2. ASTM E119 Test Method for Fire Tests of Building Construction and Materials

Steel Structures Painting Council (SSPC):

1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications"

Underwriters Laboratories Inc. (UL):

1. UL Fire Resistance Directory; applicable UL Design Numbers for application of fireproofing and conditions as indicated.

REGULATORY REQUIREMENTS

In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 7, “Fire-Resistant Materials and Construction.”

SUBMITTALS

Product Data: Submit manufacturer's product data of the intumescent fireproofing material proposed for This work, indicating product characteristics, performance, and limitations. Include topcoat coating material and color samples for exposed steel surfaces.

1. Color of the topcoat in exposed locations requires the approval of the Engineer before the topcoat may be used in the work.

Certificates: Submit certificates from an independent testing laboratory, attesting that fire protection material and installation methods meet specified fire hazard classifications and fire resistance ratings.

QUALITY ASSURANCE

Regulatory Requirements: Intumescent fireproofing shall meet or exceed the applicable requirements of the California Building Code, Chapter 7, and the applicable UL Design Number and code approval for the application of the one-hour and two-hour fire protection indicated.

Qualifications: Application of the intumescent fireproofing material shall be by a skilled and experienced applicator specializing in the application of intumescent fireproofing. Fireproofing applicator shall be approved by the manufacturer who furnishes the materials.

Manufacturer's Field Services:

1. The Contractor shall make necessary arrangements with the manufacturer of the materials to be applied to provide on-site consultation and inspection services to ensure the proper application of the intumescent fireproofing material.

2. At completion of the work, the manufacturer shall submit written certification that fireproofing material was applied over inspected and approved base steel components and that fireproofing material was applied correctly in accordance with these Specifications and the manufacturer's specifications and recommendations.

DELIVERY AND STORAGE

Deliver materials to the site in sealed containers properly marked and labeled to show manufacturer’s name, brand, and certification of compliance with requirements for fire hazard and fire resistance classifications. Damaged containers found unsuitable for use in the work will be rejected and must be removed from the site. Store materials under cover in a dry location.

PROJECT CONDITIONS

Surfaces to which fire protection material is to be applied, as well as the ambient temperature during application and for 24 hours after application, shall not fall below 50 degrees F. Relative humidity shall be low enough to assure proper drying of the applied material.

PART 2 – PRODUCTS

MATERIALS

Fireproofing Material: Epoxy-based intumescent fireproofing material for spray or brush application, with a dry film thickness of not less than 0.26 inch as required to achieve the specified one-hour and two-hour fire-resistive ratings. Fireproofing material shall be labeled by the Underwriters' Laboratories, Inc., for fire hazard classification, and evidence of the UL Classification Marking shall appear on the containers of all fireproofing material. Material containing asbestos will not be acceptable. Material shall contain the following properties and characteristics:

1. Fire-Retardant Requirements: Fireproofing material shall have been tested, classified, and listed by the Underwriters Laboratories Inc. or Warnock Hersey in accordance with the provisions of ASTM E119.

2. Surface Burning Characteristics: Fireproofing material shall have a flame-spread rating of 25 or less when tested in accordance with ASTM E84.

3. VOC Regulations: Fireproofing material shall comply with applicable California VOC Regulations as specified under “Product Requirements” in section 12-1 “General Requirements,” of these special provisions.

Decorative Topcoat Finish Material: Provide topcoat coating material for exposed steel as recommended by the fireproofing material manufacturer in color as selected by the Engineer.
Primer: Factory-applied primer with adhesion and compatibility characteristics necessary for the successful application of the fireproofing material as specified under “Structural Steel” in Section 12-5 “Metals,” of these special provisions.

MIXING

Mixing of fireproofing materials shall be in accordance with the manufacturer's instructions and recommendations.

PART 3 – EXECUTION

EXAMINATION

Verify that items that will penetrate fireproofing, including clips and hangers for piping and conduits, are properly located and installed.

Verify that interfacing installations are complete as indicated.

PREPARATION OF SURFACES

Surfaces to which intumescent fireproofing will be applied shall be cleaned of oil, grease, dirt, loose paint, mill scale, or any other matter that may impair bond of fireproofing material to steel.

Provide suitable templates, masking, or coverings to stop fireproofing material and overspray at exposed finished surfaces in sharp and neat straight lines. Provide for protection of floors and equipment from spillage and overspray.

APPLICATION

Apply fireproofing materials in accordance with the application instructions and recommendations of the materials' manufacturer and the fire test reports' information.

Fireproofing material shall be applied in minimum thickness of 0.26 inch and as required to meet UL Design requirements and code approval for one-hour fire protection of structural steel.

Apply decorative finish coating over intumescent fireproofing for exposed steel surfaces in accordance with the manufacturer's application instructions and recommendations.

PATCHING AND REPAIRING

Perform patching and repairing of fireproofing material as required to provide the one-hour and two-hour fire protection and related thickness. Include all patching and repairing of fireproofing material required after the work of other trades has been installed, such as piping and conduits, ductwork, and similar work. Re-apply fireproofing material as required to maintain fire-resistive continuity.

FIELD QUALITY CONTROL

Corrective measures, when necessary, shall be performed as required. The Contractor shall require that the manufacturer of the fireproofing material submit recommendations for corrective measures to the Engineer for approval.

The Contractor shall take frequent, dry film thickness (DFT) readings of applied material to verify compliance with thickness requirements. Measurements shall be taken in accordance with SSPC-PA2, Measurement of Dry Paint Thickness with Magnetic Gages. Submit report of such measurements to the Engineer for record purposes.

12-7.07 CONCRETE TILE ROOFING

PART 1 - GENERAL

SUMMARY

Scope: This Work shall consist of furnishing and installing concrete roofing tiles in accordance with the details shown on the plans and these special provisions.

Section Includes: Concrete tile roofing shall consist of tile units, accessory tiles, underlayment, fasteners, sealants, flashings, roof jacks, and other components necessary to provide a waterproof installation.

SYSTEM DESCRIPTION

Loading: Tile roof covering shall conform to the wind loading in Chapter 16 of the CBC and the loading shown on the plans. The installed weight of the completed tile roof covering shall not exceed 1,000 pounds per 100 square feet.

SUBMITTALS

Product Data: Manufacturer's descriptive data, standard color line and installation instructions shall be submitted for approval.

Samples:

For color selection, approximately 3 by 3 inches, actual tile samples shall be submitted.

Following color selection, three full size roofing tiles shall be submitted for approval.

One full size roofing tile shall be submitted to the Engineer at the jobsite.

WARRANTY

Special Concrete Roof Tile Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace tile that fails in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
Material Warranty Period: 50 years from date of project completion.

PART 2 - PRODUCTS

Concrete Tile: Concrete tile shall be one-piece, mission style type, interlocking, concrete tile of the shape and color shown on the plans. Tiles shall have striations on the top surface. Tile shall conform to ASTM Designation: E 1089, Class A, and shall have a permeability of a 2 inches static head of water for 24 hours. The color coat shall be impenetrable. The approximate size of the individual tile shall be 18" x 12".

Fasteners: Fasteners shall be corrosion resistant and as recommended by the tile manufacturer.

Wire Ties: Copper, 0.083-inch minimum diameter.

Twisted-Wire-Tie System: Continuously twisted two-wire unit with loops formed 6 inches apart, minimum 0.1-inch-diameter copper wire and 0.06-inch-diameter brass tie wires with matching-metal folding clip anchors.

Wind Locks: One-piece wind lock and tile fastener system, minimum 0.1-inch- diameter brass wire, for direct deck nailing.

Tile Locks: Copper, 0.1-inch-diameter wire device designed to secure butt edges of cover tiles.

Storm Clips: Stainless-steel strap-type, 0.04-by-1/2-inch L-shaped retainer clips designed to secure side edges of tiles. Provide with two fastener holes in base flange.

Bird Stop: Vented; 26 gage galvanized steel; pre-painted; in configuration of roofing tile profile; weep holes for drainage.

Battens: Galvanized steel battens as recommended by tile roof manufacturer.

Ridge Vent: 8 square inch per linear foot ventilation area, rollable; flexible to conform to roof tile profile. Butyl adhesive strips anchoring system.

Felt Underlayment: Felt underlayment shall be No. 30 minimum asphalt saturated felt conforming to ASTM Designation: D 226, Type II.

Nailing Strip: Nailing strip shall be standard grade or better Douglas fir or hem-fir.

Plastic Cement and Sealant:

Plastic cement shall be a non-running, heavy body plastic cement composed of asphalt and other mineral ingredients conforming to ASTM Designation: D 2822 and Federal Specification SCC-153, Type 1.

Sealant used in lieu of plastic cement shall be a silicone sealant conforming to ASTM Designation: D 1002 or ASTM Designation: E 42.

Mortar: Mortar shall be one part portland cement to between 2 and 4 parts sand and shall contain only enough water to pack. The color shall match the color of the tile.

PART 3 - EXECUTION

PREPARATION

Substrate: The roof deck shall be cleaned and shall be free of bumps, depressions and other surface irregularities prior to installing the tile roof covering.

INSTALLATION

Underlayment: Felt underlayment shall be laid parallel to the eaves with 4-inch head lap and 6-inch end lap and shall be nailed along the edges at 6 inches on center, except that nailing shall not be required where nailing strips hold the edges of the felt.

Nailing Strips: Nailing strip shall be placed parallel to the eaves and fastened as recommended by the tile manufacturer. For drainage, shims shall be cut from asphalt shingles and placed between the nailing strip and the deck. Nailing strips shall be fastened to the deck with 8d hot-dipped galvanized nails.

Jacks and Flashing: Jacks or flashings shall be installed at all roof penetrations.

Roofing Tiles:

Tile courses shall be laid on straight lines, parallel to the eaves in accordance with the manufacturer's instructions. The approximate weather exposure shall be 15 inches. Gable rake and ridge tile shall be fastened and shall be mortared to the field tile. Tile in contact with mortar shall be immersed in clear water for 2 minutes prior to placement. Tile cuts, if necessary, shall be made with a masonry blade. Tile shall be fastened in accordance with the tile manufacturer's recommendations.

The complete tile roof shall be weathertight.

CLEANING AND REPLACEMENT

Cleaning:

Tiles shall be kept clean of roofer’s cement, cleansers, sealants and other foreign material that my cause discoloration, etching, staining, or surface blemishes of the tiles.

Excess sealant and roofer’s cement left on the surface of the tiles or surrounding surfaces shall be removed during the working life of the materials.

Solvents and cleaning compounds shall be chemically compatible with the materials and coatings to remain.

All tiles shall be cleaned before final inspection. All stains and defects shall be removed. Paint, dirt, stains and surplus mortar, sealants and roofer’s cement shall be removed without scratching or marring the surface of the tiles.

Replacement: All cracked or broken tiles shall be replaced before completion of the work.

12-7.08 SINGLE PLY THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete fully adhered, single ply thermoplastic polyolefin (TPO) membrane roofing system in accordance with the details shown on the plans and these special provisions.

The membrane roofing system shall include rigid roof insulation, tapered rigid roof insulation, protection board, single-ply thermoplastic membrane, bonding adhesive, flashing, fasteners and other materials required, but not necessarily mentioned, which provide a complete and waterproof assembly meeting the performance requirements specified herein.

SUBMITTALS

Product Data: Manufacturer’s literature, warranty, specifications and installation instructions describing the general properties of each material and accessory to be used in the work.

Working Drawings: Provide detailed drawings for the fabrication and installation of the work. Provide detailing of single ply sheet layout including seam layout and details; roof perimeter details; interface with contiguous materials; penetrations, curbs, drains, scuppers, and projections; flashing details, including inside and outside corner reinforcements and terminations; details of expansion joints; and edge terminations including parapet flashing termination. Provide working drawings and installation drawings for the protection board, rigid roof insulation and the tapered rigid roof insulation, showing slopes and components and required fastening procedures including requirements for drains.

SYSTEM DESCRIPTION

Design Requirements:

General: Single ply TPO sheet membrane roofing and base flashing that when installed remain watertight; withstands wind loads, building movement, thermally induced movement, and exposure to weather without failure.

Material Compatibility: Roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by the roofing system manufacturer based on testing and field experience.

Performance Requirements:

Provide a total roofing system that has been tested and is equal to FM Standard 4450, FM Standard 4470 Wind Uplift Test performance requirements and is listed in FM's "Approval Guide" for a Class 1A-90 wind uplift rating.

Fire Rating: Provide a total roofing system that has been successfully tested in accordance with ASTM Designation: E 108 Class A(UL 790).

Fasteners: Fasteners shall be capable of resisting a minimum pull-out force of 800 lbs. when tested in accordance with ANSI/SPRI FX-1 for metal deck.

QUALITY ASSURANCE

Codes and standards: Single ply TPO roofing shall comply with all rules and regulations of the State of California as well as the following reference standards:

National Roofing Contractor's Association (NRCA): "Roofing and Waterproofing Manual".

Factory Mutual (FM): "FM 4450: Approval Standard for Class 1 Insulated Steel Deck Roofs"; "FM 4470: Approval Standard Class 1 Roof Covers"; "Approval Guide".

Single Ply Roofing Institute (SPRI): "Wind Load Design Guide For Low Sloped Flexible Membrane Roofing Systems"; "Fastener Selection Guide".

ANSI/SPRI FX-1 "Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners"; and ANSI/SPRI ES-1 "Wind Design Guide For Edge Systems Used With Low Slope Roofing Systems".

Qualified Installer: The single ply TPO roofing system work shall be performed by an installer having a minimum of 5 years experience in the installation of fully adhered, single ply TPO membrane roofing system on comparable projects. The installer shall have the approval of the single ply TPO roofing system materials manufacturer. The installer shall provide evidence of successful completion of work of similar scope to this project.

Single Source Responsibility: Obtain single ply TPO roofing system from one source of a single manufacturer. Obtain accessory products used in conjunction with the roofing system from the single ply TPO roofing system manufacturer or from sources acceptable to the roofing system manufacturer. The manufacturer shall furnish evidence that the specified materials have been manufactured by the same source and successfully utilized on a yearly basis for a minimum of 5 years on projects of a similar scope to this project.

Pre-roofing conference: After approval of submittals and prior to installation of any roofing materials or performing any associated work, the Contractor shall convene a pre-roofing conference with the installer, membrane roofing manufacturer, and Engineer. Discussions and agreements shall be recorded and copies furnished to each participant. Advance notice of meeting shall be given in writing to each participant at least 72 hour prior to the meeting.

WARRANTIES

Warranty for Single Ply TPO Roofing System: Upon completion of the work, provide manufacturer's standard warranty for single ply TPO membrane roof assembly for a period of ten (10) years. Warranty shall commence from the date on which the total roof assembly is completed and shall state that the roof, including integral flashings, shall remain in a watertight condition. Upon notification of defects, within the warranty period, make the necessary repairs or replacements, including cost of materials and labor, at the convenience of the Department.

PART 2 – PRODUCTS

GENERAL

Performance: Roofing materials shall be provided which are recognized to be of generic type indicated and tested to show compliance with indicated performance.

Compatibility: Products which are recommended by the manufacturer shall be fully compatible with the substrates used.

Roofing System: Provide single ply TPO sheet roofing system, including but not limited to thermoplastic polyolefin sheet, flashing, edge lap sealant, substrate membrane adhesive, mastics, thinners, sealers, release agents, sheet activators, sheet primers and solvents; rigid insulation boards, membrane termination bars, clamping rings, fasteners and other accessories recommended by roof membrane manufacturer for a complete system.

SINGLE PLY TPO MEMBRANE MATERIALS

Thermoplastic polyolefin sheet roofing shall conform to the requirements of ASTM Designation: D 6878, and have fabric backing. Membrane shall be 60 mils nominal thickness and white in color. Width and length of membrane sheets shall be as recommended by the manufacturer.

Flashing Membrane: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils minimum thickness and white in color, shall be supplied for field-fabricated flashings for vent stacks, pipes, drains and corners.

Edge Lap Sealant: Use the type as recommended by the manufacturer of single-ply membrane.

Protection Board: Protection board shall be glass mat gypsum roof board conforming to the requirements of ASTM Designation: C 1177.

Substrate Membrane Adhesive: Use the type as recommended by the manufacturer of single-ply membrane and compatible with the substrate. Substrate membrane adhesive type shall be designed and tested so as to comply with FM Class 1-90 wind uplift rating.

Mastics, Thinners, Sealers, Release Agents, Sheet Activators, Sheet Primers and Solvents: Use the type as recommended by the manufacturer of single ply TPO roofing system materials for cold applied installations.

INSULATION MATERIALS

Rigid insulation board and tapered rigid insulation board shall be rigid cellular polystyrene thermal insulation conforming to the requirements of ASTM Designation: C578, Type IV.

Provide preformed, tapered insulation boards, preformed saddles, crickets, tapered edge strips, and other insulation shapes as required by the manufacturer and as shown on the plans.

Insulation thickness shall be as shown on the plans.

FASTENERS

Fasteners: Stainless steel, factory coated galvanized steel or other corrosion resistant type; size, configuration, components and accessories as recommended and supplied by the single ply membrane manufacturer and approved by the insulation manufacturers. Provide fastener system equal to FM Class 1A-90 wind uplift rating and compatible with substrate, roofing membrane, adhesives and other products in contact with fastener.

Membrane Termination Bar: Roof membrane manufacturer approved, pre-drilled, stainless steel with splayed top to receive sealant bead; longest lengths available.

PART 3 - EXECUTION

Manufacturer's Instructions: Prepare substrates, apply primers and install single ply TPO membrane roofing system, including accessories, in accordance with the manufacturer's instructions, except where more stringent requirements are specified in these special provisions.

PREPARATION

Cleaning of Substrate: Clean substrate of debris and deleterious materials which would impair the installation of the roofing system, or otherwise cause damage to the system or any of its components.

Penetrations: All penetrations or projections through the roof deck shall be installed prior to beginning roof system installation. Holes, cavities and joints greater than 1/4 in. shall be filled and finished flush in utilizing recommended materials.

INSTALLATION

General: Install and complete the system to assure that no water leakage through the system occurs. Provide overnight seals to prevent moisture penetration at the end of each workday and when weather threatens using materials and methods.

Metal Items Installation: Anchor metal items to wood nailers utilizing materials and methods shown in the working drawings. Terminate single ply membrane in areas contiguous with metal items.

Treatment at Joints: Provide treatment at joints in substrate, cracks and penetrations as required and with such materials and designs. Fill non-moving cracks and joints with sealant or other compounds compatible with the single ply TPO roofing system.

Priming: Prime metal substrates using recommended products and methods.

Insulation Installation:

Extend insulation over entire surface as indicated, cutting and fitting tightly around obstructions.

Secure the insulation to the substrate utilizing specified mechanical fasteners in the patterns as required to comply FM-1-28 and with the specified wind uplift criteria, but no less than one (1) fastener per each square foot at corners, 1.33 fastener per sq. ft at the perimeter and one (1) fastener per two square feet of field area. Predrill holes for fastener installation utilizing recommended fastener lengths and depth of embedment for various types of substrates. Provide stress plates fabricated form same material as fasteners which will not cause the stress distribution surface to become concave or deform. Fasteners shall be installed with a depth-sensing screw gun to prevent overdriving or under driving. Remove and replace fasteners which are overdriven, underdriven, snapped, bent, not engaged or in any manner not properly installed.

Continuous joints between insulation boards and parallel to decking flutes shall not occur over the flute openings. Boards shall have full edge bearing on rib tops.

Insulation boards with broken or crushed corners or edges shall be trimmed free of such defects or shall be discarded. Replacement boards less than 12 inches wide shall not be used.

End joints between insulation boards shall be staggered as recommended by the manufacturer.

Single Ply Membrane Installation:

Apply single ply TPO roofing, as a complete, water-tight system.

Apply the single ply membrane in the longest lengths possible. Adhere membrane to the protection board in a continuous bed of adhesive. Install membrane free from bubbles, wrinkles, folds or other surface defects. In addition to the full bed of adhesive, provide mechanical fasteners at terminations and perimeter to assure compliance with wind uplift requirements.

Lap seams in the direction of drainage Wash seams with recommended solvent prior to heat welding. Hot air weld seams and joints using an automatic hot air welder with accurate calibrated temperature gauge at nozzle to provide smooth flat seams free from bubbles, wrinkles, folds or other surface defects. Apply a continuous bead of edge lap sealant to seams and joints which have had the factory edge cut or abraded.

Install flashing membrane using recommended products and systems:

Set metal flanges in adhesive mastic. Strip metal flanges with flashing membrane set-in adhesive. Seal selvages, seams and joints. Where membrane or flashings terminate against parapet walls, curbs, pipe and vent penetrations and other such obstructions, provide termination bars and pipe clamping rings. Provide continuous sealant bead at top of termination bars and clamping rings.

Install membrane at terminations, penetrations and other interruptions of the roofing membrane. Provide mechanical fasteners, flashings counterflashings and accessories at recommended locations. Provide temporary seals and night seals to protect the insulation and the building interior.

FIELD QUALITY CONTROL

At the start of the installation and throughout the installation period, as often as deemed necessary by the Engineer, the TPO membrane roofing manufacturer's technical representative shall be present at the jobsite to advise on the installation of the roofing system.

The representative shall also provide inspection and testing of the field seams to assure manufacturer's quality requirements are maintaining throughout the installation period. Each field seam including expansion joints, shall be 100% inspected and a written report prepared by the single ply TPO membrane manufacturer shall be submitted for review prior to final acceptance.

12-7.09 SHEET METAL FLASHING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of fabricating, furnishing and installing sheet metal flashing in accordance with the details shown on the plans and these special provisions.

Section Includes: Sheet metal shall include metal flashings, counterflashings, straps, gutters, downspouts, roof jacks, gravel stops, reglets, copings, scuppers, conductor heads, and screen type vents.

Alternatives: Premolded roof flashings may be used in lieu of sheet metal flashings where shown on the plans.

SUBMITTALS

Product Data: Submit manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

Samples for Initial Selection Purposes: Submit manufacturer's color charts and texture variations for specified sheet materials to be exposed as finished surfaces.

QUALITY ASSURANCE

Installer Qualifications: Engage an experienced installer who has completed flashing, sheet metal, and trim work similar in material, design, and extent to that indicated for project that have resulted in construction with a record of successful in-service performance.

Standards:

Sheet metal work shall in accordance with the requirements in the latest edition of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Standard Practice in Architectural Sheet Metal Work."

International Nickel Company: "Stainless Steel Roofing, Flashing and Accessories Volume 3".

Copper Development Association (CDA) "Contemporary Copper" and "Publication No. 120/2 "Welding, Soldering, Brazing and Surfacing of Copper and Copper Alloys

Wind Resistance: Fabricate and install flashings at edges of roof in accordance with FM Loss Prevention Data Sheet 1-49 for specified wind zone. Ensure that substrate construction is also in compliance.

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: 100ºF, ambient; 150ºF material surfaces.

PART 2 - PRODUCTS

MATERIALS

General: Unless otherwise indicated, provide:

Aluminum-Zinc Alloy-Coated Steel Sheet : ASTM A792, Class AZ-50 coating, grade 40, or to suit project conditions, with 55 percent aluminum, not less than 0.0336 inch thick; mill finish.

Sheet Aluminum: Sheet aluminum shall be not less than 0.032 inch thick, mill finish, 3003-H14 alloy, conforming to ASTM Designation: B 209M.

Sheet Lead: Sheet lead shall be not less than 0.062 inch thick, conforming to ASTM Designation: B 749.

Copper Flashing: ASTM B370, cold rolled temper, 16 ounce weight, unless otherwise shown: or in lieu thereof, ASTM B465 light annealed temper, 0.015 in. thick may be used where 16 ounce material is specified.

Premolded Roof Flashing: Premolded flashing shall be premolded neoprene or ethylene propylene diene monomer (EPDM) flashing, resistant to ozone and ultraviolet. Units shall have overlapping tab to flash the seam.

1. Hardware and Fastenings: Hardware and fastening for premolded roof flashings shall be stainless steel.

REGLETS

General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

Surface Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

Masonry Type: Provide with offset top flange for embedment in masonry mortar joints.

Counterflashing Wind-Restraint Clips: Provide hold down clips with 1/2 inch kickout to be installed before counterflashing to prevent wind uplift on the counterflashing lower edge. Fabricate the clips of the following materials:

1. Galvanized Steel: 22 gage; 0.0336 inch thick.

MISCELLANEOUS MATERIALS AND ACCESSORIES

Solder: Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

Solder for Stainless Steel: ASTM B32; provide 60% tin- 40% lead solder, with acid-chloride type flux, except use rosin flux over tinned surfaces.

Solder for Copper: ASTM B32; provide 50% tin - 50 % lead solder, with rosin flux.

Soldering Flux: Soldering flux shall be acid type, conforming to Federal Specification: O-F-506C, Type I, Form A.

Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

Installation Accessories: Provide joint tape, adhesives, sealers, and fasteners as recommended by flashing manufacturer for indicated applications.

Insect Screen: Insect screen shall be industrial wire cloth and screen, medium grade, 18 mesh, 0.017-inch diameter, 0.039-inch openings, plain weave, galvanized steel conforming to ASTM Designation: E 437.

Lap Joint Sealant: Lap joint sealant for concealed locations shall be a non-drying butyl.

Flashing Cement: Flashing cement shall be a bituminous plastic cement, asbestos free, conforming to ASTM Designation: D 4586, Type II.

Sealant: Sealant for exposed locations shall be a silicone sealant conforming to ASTM Designation: C 920.

Primer: Primer shall be as recommended by the sealant manufacturer.

Coal Tar Paint: Coal tar paint shall be coal-tar epoxy coating conforming to U.S. Corps of Engineers Specification: C-200 or Steel Structures Painting Council Paint Specification: SSPC-16-68T.

FABRICATION, GENERAL

Sheet metal shall be fabricated to Sheet Metal and Air Conditioning Contractors National Association Standards.

Sheet metal shall be formed to the sizes, shapes and dimensions shown on the plans or as specified herein with angles and lines straight, sharp and in true alignment. The number of joints shall be kept to a minimum. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal flashing and trim work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

Angle bends and folds for interlocking the metal shall be made with full regard for expansion and contraction to avoid buckling or fullness in the metal after it is installed.

Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Watertight joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

Sheet metal joints to be soldered shall be cleaned with steel wool or other means, pre-tinned and soldered watertight.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

Flashings shall have a 45 degree drip return at bottom edges. Unless otherwise shown on the plans, counterflashing shall extend not less than 4 inches over roofing or other materials protected by the counterflashing and shall be arranged so that roofing or materials can be repaired without damage to the counterflashing. Where reglets are indicated, counterflashing shall be fastened by lead wedges or snap-in flashing.

Roof penetrations: stainless steel type 304, vandal proof, provide isolators to avoid contact between dissimilar metals.

SHEET METAL FABRICATIONS

General: Unless otherwise indicated and as a minimum, fabricate flashings using materials in the thickness listed for each flashing application.

1. Exposed Flashings-Low Slope Roofs or Waterproofing: Formed copings, gravel stops and scuppers: Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch).

2. Semiconcealed Flashings-Low Slope Roofs or Waterproofing: Counter flashing, reglets, equipment support flashing, roof area joint and roof expansion joint covers and pipe/conduit penetration flashing: Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch).

3. Miscellaneous Flashings: Aluminum-Zinc Alloy-Coated Steel Sheet: 24 gage (0.0276 inch).

PART 3 - EXECUTION

Preparation: Surfaces to receive sheet metal shall be clean, smooth and free from defects.

Protection: Aluminum surfaces to be in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

INSTALLATION

Roof Penetration Flashings:

All pipes, ducts, vents and flues passing through roofs shall be made waterproof with flashings of storm collars or counterflashings.

Roof penetration flashings shall be fabricated from stainless sheet steel, not less than 24-gage. Size and shape shall be as shown on the plans.

The lower flashing shall be stainless steel sheet metal, 24-gage, and extend 6 inches minimum from outside of the pipe in all directions and 1½ inches above the top of the roofing.

The top flashing shall be stainless sheet steel or sheet lead as shown on the plans.

Gutters:

Gutters shall be size and shape as shown on the plans. Where shown, provide copper gutters of profiles and dimensons shown.

Gutters shall be fabricated in sections not less than 10 feet in length. Use sections as long as practicable for lengths over 10 feet.

Joints shall be lapped at least 1½ inches, rivet and solder watertight. Butt type expansion joints, ¾ inch wide, shall be provided at midpoint between down spouts and where expansion joints occur in the structure.

Downspouts:

Unless noted otherwise, Downspouts shall be fabricated from copper sheet, not less than 0.0863 inch. Size and shape shall be as shown on the plans. Where indicated provide copper downspouts of profiles and dimensions shown. Isolate from dissimilar metals.

Downspouts shall be installed as shown on the plans, secured to the wall with straps near top, bottom and at intermediate points not more than 8 feet apart. Straps shall extend 2 inches out on wall and be secured with suitable anchors.

Unless otherwise shown on the plans, the lower end of downspout shall terminate with mitered 45 degree elbow.

Rain Chains: 2 inch oval double loop; 9 gage copper; soldered joints; with manufacturer's gutter hole bolt accessory.

Premolded Roof Flashings: Premolded roof flashings shall be installed in accordance with the manufacturer's instructions.

Gravel Stops:

Gravel stops shall have upstanding lip, an apron with drip edge and 4-inch minimum width roof flange. Joints between lengths shall be ½ inch wide sliding joints with 12-inch long internal sleeves set in plastic cement. Corners shall be mitered and soldered. Gravel stops shall be set in ¼-inch thick bed of plastic cement and stagger nailed at 3-inch centers on the roof flange. Nails shall be one inch from the edge of the roof flange. Blind clips of galvanized steel shall be provided.

After metal work is completed and watertight, flashings and gravel stops shall be covered by one of the following methods:

The top of the stop flanges and inside the upstanding lip at the joints shall be cleaned with an acid etching detergent, rinsed and dried. A ½-inch thick coat of plastic cement shall be applied on the roof flange and onto the roofing at least 4 inches wide. A ½-inch thick coat of plastic cement shall be applied 4 inches wide on the upstanding lip at the joints.

A hot mopping of roofing asphalt or a uniform coating of plastic cement shall be applied, over which shall be laid Type IV asphalt saturated felt strips, 10 inches and 13 inches wide, in 2 layers over the flange of the stops feathered out onto the roofing.

CLEANING AND PROTECTION

Remove protective film from prefinished sheet metal immediately after installation.

Repair or replace work which is damaged or defective, as directed by the Engineer.

1. Refinish marred and abraded areas of prefinished sheet using finish manufacturer's recommended methods and materials. Replace units which cannot satisfactorily be refinished in place.

Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

Provide final protection and maintain conditions that ensure sheet metal flashing and trim work during construction is without damage or deterioration other than by natural weathering.

12-7.10 ROOF ACCESSORIES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing roof specialties in accordance with details shown on the plans and these special provisions.

Section Includes: Hatch-type heat and smoke vents, dome-type heat and smoke vents, roof hatches (scuttles), prefabricated ridge ventilators, and prefabricated curb and equipment support units.

Related Sections:

Ridge vents for steep-slope roofing are specified in steep-slope roofing Sections in Section 12-7 "Thermal and Moisture Protection," of these special provisions.

Shop and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories are specified under "Sheet Metal Flashing" in Section 12-7 "Thermal and Moisture Protection," of these special provisions.

Small individual skylights are specified under "Unit Skylights" in Section 12-7 "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, rough-in diagrams, installation instructions and general product recommendations shall be submitted for approval.

Samples: Five samples, minimum 8 inches square, of each exposed metal and plastic sheet materials, and 2 samples, minimum 24 inches long, of formed or extruded metal member each color and finish specified shall be submitted for approval.

Coordination Drawings: Coordination drawings for items interfacing with or supporting mechanical or electrical equipment, ductwork, piping or conduit, shall be submitted for approval. Drawings shall indicate dimensions and locations of items provided in this special provision, together with relationship and methods of attachment to adjacent construction and to mechanical and electrical items.

QUALITY ASSURANCE

Labels: Units shall be provided which have been tested, listed, and bear the label of UL, FM or other recognized testing agency.

Standards:

1. Prefabricated units shall conform to the requirements of SMACNA, "Architectural Sheet Metal Manual," details for fabrication of units, including flanges and cap flashing to coordinate with types of roofing involved.

2. International Nickel Company: "Stainless Steel Roofing, Flashing and Accessories Volume 3".

3. Copper Development Association (CDA): "Contemporary Copper" and "Publication No. 120/2 "Welding, Soldering, Brazing and Surfacing of Copper and Copper Alloys

PART 2 - PRODUCTS

Manufacturer's standard units, modified as necessary, shall be provided to comply with the contract requirements. Each unit shall be shop fabricated to the greatest extent possible.

MATERIALS

Sheet Steel: Sheet steel shall be structural quality conforming to the requirements of ASTM Designation: A 570.

Aluminum-Zinc Alloy-Coated Steel Sheet : ASTM A792, Class AZ-50 coating, grade 40, or to suit project conditions, with 55 percent aluminum, not less than 0.0336 inch thick, unless otherwise indicated; mill finish .

Stainless Steel: Stainless steel shall conform to ASTM Designation: A 167, Type 302/304 or Type 316, with No. 4 finish . Stainless steel shall be tempered as required for forming and performance.

Aluminum Sheet: Aluminum sheet shall conform to the requirements of ASTM Designation: B 209, tempered as required, Duranar or Hynar finish, except furnish mill finish where field painting is required.

Extruded Aluminum: Extruded aluminum shall be the manufacturer's standard extrusions of sizes and profiles required.

> High-Performance Organic Finish: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

Copper Sheet: ASTM B370, cold rolled temper, 16 ounce weight, unless otherwise shown; or in lieu thereof, ASTM B465 light annealed temper, 0.015 in. thick may be used where 16 ounce material is specified.

Insulation: Insulation shall be the manufacturer's standard rigid or semi-rigid board of glass fiber and shall be the thickness required.

Wood Nailers: Wood nailers shall be softwood, pressure treated with copper napthenate, pentachlorophenol, or water-borne arsenicals (ACA, CCA or ACZA); not less than 2-inch nominal thickness.

Fasteners: Fasteners shall be the same metal as the metal to be fastened, or other non-corrosive metal as recommended by the unit manufacturer. Finish of the fastener shall be the same finish as the metal being fastened.
Solder: Solder shall conform to ASTM Designation: B 32, Alloy Grade Sn50.

Solder for Stainless Steel: ASTM B32; provide 60 percent tin- 40 percent lead solder, with acid-chloride type flux, except use rosin flux over tinned surfaces.

Solder for Copper: ASTM B32; provide 50 percent tin - 50 percent lead solder, with rosin flux.

Bituminous Coating: Bituminous coating shall be as recommended by the unit manufacturer for the use specified.

Gaskets: Gaskets shall be tubular or fingered design of neoprene or polyvinyl chloride as recommended by the unit manufacturer.

PREFABRICATED HEAT/SMOKE VENTS

Units shall be custom fabricated only to the extent necessary for compliance with the dimensions shown on the plans or other requirements. External loading shall be not less than 40-pound live load per square foot and internal loading shall be not less than 20 pounds per square foot.

Units shall be fabricated from stainless steel, with manufacturer's standard one piece and two-piece welded or sealed mechanical corner joints, including cap flashing.

Curb shall be double wall construction with cant strips and one-inch insulation of height shown on plans or, unless otherwise noted, for mounting with height of 9 inches above line of roofing. Vents shall have roof flange for attachment to roof deck.

Where roof slopes more than 2 percent, tapered curb heights shall be furnished to match the slope and the resulting top of unit shall be level.

PREFABRICATED ROOF HATCH (SCUTTLE)

Roof scuttles shall be of sizes indicated, furnished complete with all necessary hardware and installation accessories. Curb and cover shall be fabricated from 14 gage stainless steel, and cover liner from a minimum 22 gage stainless steel. Provide cover with rubber draft seal. Cover insulation shall be glass fiber, minimum 1 inch in thickness.

Roof scuttle shall be galvanized, treated for paint adherence, and shop coated with an approved metal primer before delivery.

Provide roof scuttle complete with required operating hardware, including positive snap latch with turn handles and padlock hasps inside and outside. Hardware shall be stainless steel.

PREFABRICATED ROOF VENTILATOR

Roof ventilator shall be continuous, ridge type, gravity operated ventilator with integral base; equipped with positive closing, screw type adjustable damper, bird screen and end closures; ventilator width shall be greater than twice the throat width. Ventilator shall be fabricated from Aluminum-Zinc Alloy-Coated Steel Sheet not less than 24-gage.

Damper handle shall be removable, designed to extend to approximately 4 feet above the finished floor.

PREFABRICATED CURB AND EQUIPMENT SUPPORTS

Curb and equipment support shall conform to the loading and strength requirements of the equipment to be supported. Dimensions shall conform to the dimensions shown on the coordination drawings of equipment to be supported. Unit shall be fabricated from Aluminum-Zinc Alloy-Coated Steel Sheet.
Units shall be fabricated with welded or sealed mechanical corner joints, complete with cant strips and base profile coordinated with roof insulation thickness. Wood nailers shall be provided at top of curb tapered as necessary to compensate for roof slopes of 2 percent.

Where roof slope is more than 2 percent curb or equipment supports shall be fabricated with height tapered to provide a level installation.

COPING

Provide aluminum bull nose coping system. All exposed aluminum shall have Duranar or Hynar finish.

PART 3 - EXECUTION

INSTALLATION

Prefabricated units shall be installed in accordance with the manufacturer's instructions and approved coordination drawings.

Installation of the units shall be coordinated with installation of the roof decking and other substrates to receive accessory units, vapor barriers, insulation, roof and flashing materials.

Units shall be securely fastened to supporting members, adequate to withstand all lateral, inward or outward loading pressures.

Where metal surfaces are to be installed in contact with non-compatible metals or other corrosive substrates, including wood decking, bituminous coatings shall be applied to metal surfaces.

Except as noted above, roof flanges shall be set in a thick bed of roofing cement to form a watertight seal.

Operational Testing: Units with operational components shall be fully tested. Joints and hardware shall be cleaned and lubricated. All units shall be adjusted for proper operation.

CLEANING AND PROTECTION

All exposed metal and plastic surfaces shall be cleaned in accordance with the manufacturer's instructions. Damaged metal coatings shall be repaired.

12-7.11 UNIT SKYLIGHTS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing skylights in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Design Requirements:

Skylights shall conform to the requirements on Section 2603.7 of the CBC.

Skylights shall be rated by the manufacturer to withstand a 40 pounds per square foot live loading.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

Samples: A 12 inch by 12 inch sample of the acrylic plastic and the framing assembly shall be submitted for approval.

PART 2 - PRODUCTS

Skylight: Factory assembled sealed pyrimid plastic skylight units; complete with extruded aluminum thermally broken frame system with integral drainable condensation gutters and counter flashing to roof curb.

1. Assembly U Value: 0.35.

2. Frame: Retaining and curb framing shall be 6063-T5 aluminum with mitered, full welded corners and condensation weeps to the outside.

3. Skylight shall be thermally broken. Triple glazing; separate glazing from framing; Shading Coefficient: 0.64; Light Transmission: 0.71; EDPM rubber seal. Provide safety-security guard.

Finish: 3-coat Polyvinylidene fluoride (PVDF) conforming to AAMA 2605 "Superior Performing Organic Coatings on Aluminum Extrusions and Panels." Acceptable Finish Systems: Duranar XL , Hylar 5000, or equal.

PART 3 - EXECUTION

INSTALLATION

Coordinate unit skylight installation with installation of substrates, vapor retarders, roof insulation, roofing, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

Where metal surfaces of units will contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

Anchor unit skylights securely to supporting substrates.

Set unit skylight flanges in thick bed of roofing cement to form a seal, unless otherwise indicated.

Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

CLEANING

Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

12-7.12 JOINT SEALANT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of preparing and placing a joint sealant in accordance with the details shown on the plans and these special provisions.

The sealed joint shall consist of tempered hardboard, expanded polystyrene and a pourable joint seal.

SUBMITTALS

Product Data: Manufacturer's descriptive data, specifications and installation instructions shall be submitted to the Engineer at the jobsite for approval.

PART 2 - PRODUCTS

Tempered Hardboard: Tempered hardboard shall be 1/8-inch minimum thickness, commercial quality suitable for the use intended. Other facing materials may be used provided they furnish equivalent protection.

Expanded Polystyrene: Expanded polystyrene shall be commercially available polystyrene board.

Polyethylene Foam: Polyethylene foam shall be commercial quality, with a continuous, impervious, glazed top surface, suitable for retaining the liquid sealant in the joint while hardening.

Primer: Primer shall be as recommended by the sealant manufacturer.

Joint Sealant: Joint sealant shall be a commercial quality, 2 component polyurethane sealant, which shall be self-leveling and withstand up to 25 percent movement.

PART 3 - EXECUTION

PREPARATION

Forming:

Groove for joint seal shall be formed to a uniform width and depth and to the alignment shown on the plans or as ordered by the Engineer. The completed groove shall have a top width within 1/8 inch of the width shown on the plans and the bottom width shall not vary from the top width by more than 1/16 inch.

At least 24 hours prior to installing the joint seal, the Contractor shall repair all spalls, fractures, breaks, or voids in the concrete surfaces of the joint groove.

The lip of the joint shall be beveled by grinding as shown on the plans.

Cleaning:

Prior to sealing joints, expanded polystyrene, hardboard, concrete spillage and all foreign material shall be removed from the deck to the bottom of the formed joint.

Prior to placing the joint seal, the joint shall be cleaned by a method which shall include abrasive blast cleaning and then be cleaned with a high pressure air jets to remove all residue and foreign material.

INSTALLATION

General:

No material shall be used which has skinned over or which has settled in the container to the extent that it cannot be easily redispersed by hand stirring to form a smooth uniform product.

Each container of material shall be clearly labeled or each delivery of material in the tanks of 2-component equipment shall be accompanied with a ticket showing designation (Component A or B), the manufacturer's name, lot or batch number, date of manufacture, date of packaging, and date, if any, beyond which the sealant shall not be used.

Primer: A primer shall be applied to the sides of the groove and all exposed vertical surfaces in the joint prior to placing the sealant. Primer shall be dry at the time of placing the sealant. Contaminated primer shall be removed and replaced.

Joint Sealant: The 2-component sealant shall be mixed and placed in the groove in accordance with manufacturer's instructions. Unmixed liquid components which have been exposed to the atmosphere for more than 24 hours, shall not be used.

12-7.13 EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing vertical and horizontal expansion joint assemblies, fillers and sealers for expansion and seismic joints in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions for vertical and horizontal expansion joint assemblies, seals and sealants shall be submitted for approval. Standard color palette for exposed seals shall be submitted for selection and approval. All roof cover transitions to vertical wall covers shall be clearly detailed and supplied by the same manufacturer.

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturers: Subject to these special conditions, acceptable manufacturers shall be In Pro Corporation; CS Group; MM Systems; or equal.

MATERIALS

Expansion joint closures and seals shall be aluminum extrusions and neoprene or silicone rubber seals of the type and size to suit the construction as shown on the plans. The installation shall include factory, heat welded transitions, where applicable to ensure water tight system. Seal frames with continuous adjustable angle flange folded on-site to cover adjacent edge of roof membrane. All transitions and end caps shall be factory fabricated to ensure maximum weather tightness. Seal all butt joints with aluminum splice cover bedded on caulk and fastened on one side only.

Aluminum Retainers and Cover Plates: Aluminum retainers and cover plates shall conform to ASTM Designation: B 221M, 6063-T5, anodized, of the configuration and size indicated or recommended by the expansion control system manufacture.

Visual Seals: Visual seal shall be dense neoprene or dense silicone synthetic rubber conforming to ASTM Designation: C 864, 70 durometer hardness, plus or minus 5.

Functional Seal: Functional seal shall be EPDM sheet, or fabric reinforced gutter.

Fasteners: Fasteners shall be the expansion joint assembly manufacturer's standard corrosion resistant fasteners.

Sealant: Sealant shall be as recommended by the expansion joint assembly manufacturer.

PART 3 - EXECUTION

PREPARATION

Surface Preparation: Supporting joint surfaces shall be prepared as recommended by the manufacturer. Edges of the substrate shall be level and sound.

INSTALLATION

Expansion joint cover assemblies shall be installed and set to the proper width for the ambient temperature at the time of setting.

Nominal width shall be based on an ambient width shown on the plans.

Expansion joint cover assemblies shall be set according to the manufacturer's recommendations.

CLEANING

Unused materials, containers, and equipment shall be removed from the work area.

Surfaces that are stained, marred or otherwise damaged shall be cleaned and repaired.

12-7.14 SEALANTS AND CAULKING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and applying sealants and caulking which are required for this project, but not specified elsewhere, in accordance with the details shown on the plans and these special provisions.

Related Work: Pourable polyurethane joint sealant shall conform to the requirements under "Joint Sealant" elsewhere in this Section 12-7.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of compliance shall be furnished for the sealants and caulking in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions for all sealants shall be submitted for approval.

Samples: Color samples of all sealants shall be submitted for approval. Unless otherwise shown on the plans, colors will be selected by the Engineer from the manufacturer's standard colors.

PART 2 - PRODUCTS

MATERIALS

All sealants, primers and accessories shall be non-staining to adjacent exposed surfaces. Products having similar applications and usage shall be of the same type and same manufacturer. Gun consistency compound shall be used unless otherwise required by the job conditions.

Acrylic Sealant: Acrylic sealant shall be one compound, solvent release acrylic sealant.

Butyl Sealant: Butyl sealant shall be one component, skinning type.

Silicone Sealant: Silicone sealant shall be one component, low modulus building sealant. Sealant shall be tack-free in one hour, shall not sag or flow, shall be ozone resistant and capable of 100 percent extension without failure.

Backer Rod: Backer rod shall be round, open or closed cell polyurethane. Backer rod shall be sized such that it must be compressed between 25 percent and 75 percent of its uncompressed diameter during installation in the joint.

Neoprene: Neoprene shall conform to the requirements of ASTM Designation: C 542.

PART 3 - EXECUTION

APPLICATION

Unless otherwise shown on the plans, sealants shall be applied in accordance with the manufacturer's instructions.

Silicone sealants shall not be used in locations where painting is required.

Butyl sealants shall not be used in exterior applications, and acrylic sealants shall not be used in interior applications.

Sealants shall be applied in a continuous operation for the full length of the joint. Immediately following the application of the sealant, the sealant shall be tooled smooth using a tool similar to that used to produce concave masonry joints. Following tooling, the sealant shall remain undisturbed for not less than 48 hours.

SECTION 12-8 DOORS AND WINDOWS

12-8.01 HINGED DOORS

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing hinged doors and frames in accordance with the details shown on the plans and these special provisions.

DEFINITIONS

Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

SUBMITTALS

Manufacturer's descriptive data, installation instructions for fire rated assemblies and a door schedule shall be submitted for approval. The door schedule shall include a description of the type, location and size of each door and frame.

Working Drawings: Submit Working Drawings for hollow metal doors and frames showing size, location, and elevation of each metal door and frame, gage and type of material, details for fabrication of each door and frame, including size and location of each mortise, penetration, reinforcement, sound seal, light, louver, and anchoring device. Indicate the quantity of each size and type of door and frame. Comply with applicable requirements of SDI 100 and SDI 111 Series Drawings.

Product Data: Submit manufacturer's product data of each type of door and frame and
certification that materials meet Specification requirements.
Reports and Certificates:

1. Submit certified test reports from an independent testing laboratory of sound transmission class (STC) ratings for acoustical door assemblies.

2. Submit certificates of inspection as required for fire-rated doors.

QUALITY ASSURANCE

Manufacturing Standards: Comply with applicable requirements of SDI 100.

Manufacturing Tolerances: Comply with applicable requirements of DHI A115 and SDI 117.

Fire-Rated Doors and Frames: Comply with applicable requirements of DHI A115, SDI 100,
and SDI 118. Classification shall be based on door-and-frame assemblies tested in accordance with ASTM E152.

Acoustical Doors and Frames: Comply applicable requirements of DHI A115, SDI 100 and

SDI 114. Sound transmission class (STC) ratings shall be based on door-and-frame assemblies tested in accordance with ASTM E90.

PART 2 - PRODUCTS

General: Doors shall be prepared and reinforced for installation of hardware in accordance with DHI A A115 and SDI 107

Steel Doors:

Steel doors shall be flush, seamless steel door factory prepared and reinforced to receive hardware and having cold rolled stretcher leveled sheet steel face sheets not less than 0.048 inch thick (18-gage). Face sheets shall be bonded with thermosetting adhesive to rigid board honeycomb or precured foam core; or face sheets shall be welded to all parts of an assembled grid of cold formed pressed metal stiffeners and framing members located around edges, ends, openings and at all locations necessary to prevent buckling of face sheets. Seams shall be tack welded, filled and ground smooth. Bottom edge and internal stiffeners of grid type core shall have moisture vents. Welds on exposed surfaces shall be ground smooth. Louvered or glazed openings shall be provided where shown on the plans.

Active leaf of double door shall have a full height astragal of 1/8-inch flat bar or folded sheet strip, not less than 0.060 inch thick (16-gage), welded on the outside of the active leaf.

Finishes:

1. Steel doors and fames shall be treated for paint adherence and given a baked-on corrosion-inhibitive prime coat of metallic oxide or synthetic resin primer in accordance with SDI 100 and meeting acceptance criteria of ANSI A224.1.

2. Finish field painting is specified under "Painting" in Section 12-9 "Finishes," of these special provisions.

Aluminum Door: Aluminum door shall be glazed door with medium stiles of not less than 1/8-inch nominal wall thickness, clear anodized, thermally treated and artificially aged 6061 or 6063 extruded aluminum alloy tubing reinforced to receive hardware.

Aluminum Finishes: Polyvinylidene fluoride (PVDF) conforming to AAMA 2605 “Superior Performing Organic Coatings on Aluminum Extrusions and Panels.” Acceptable Finish Systems: Duranar XL , Hylar 5000, or equal.

Stainless Steel Door: Grade III - Extra Heavy Duty, Model 2, Seamless, hollow steel construction, internally reinforced with minimum 22 gage continuous vertical formed steel sections spanning the full thickness of the interior space between door faces, securely attached to face sheets by spot welds spaced maximum 5-inches on center. Minimum face gage shall be 16-gage. Spaces between internal stiffeners shall be filled to full height of door with chemically inert, noncombustible moisture-resistant mineral fiber. Sizes and thicknesses as indicated. Doors shall be fabricated from Type 304 stainless steel. Surfaces exposed to view shall be “Angel Hair” non-directional finish.

Glazing for Doors: Glazing for doors shall be safety glass as specified under "Glazing" in Division 8, "Doors and Windows," of these special provisions. Glazing shall be not less than 3/16 inch thick.

Door Louvers: Door louvers shall be inverted V-type factory primed, galvanized sheet steel louvers. Exterior door louvers shall not be removable from outside of the building. Louvers at exterior doors shall have inside mounted bronze insect screens.

Fire Rated Louvers:

Fire rated louvers shall be factory fabricated, multi-blade adjustable fire damper type units of galvanized steel sheet not less than 3/16 inch thick (16-gage) with a 160°F fusible link and removable bronze 16 x 16 mesh insect screen mounted on the inside of the units. Fire rated louvers shall be listed for the fire rating shown on the plans.

Louvers shall be cleaned and treated by the bonderized process or approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Pressed Metal Frame:

Pressed metal frame shall be not less than 0.060-inch thick (16-gage) sheet steel with integral stop, mitered corners, face welded and ground smooth corners. Frames shall be reinforced for all hardware and shall be cleaned and treated by the bonderized process or an approved phosphatizing process and then given one factory application of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.

Frames for fire rated doors shall be listed for the same rating shown on the plans for fire rated doors.

Aluminum Frame: Aluminum frame shall be manufactured by aluminum door manufacturer of clear anodized thermally treated and artificially aged 6061 or 6063 aluminum alloy extrusions with minimum nominal wall thickness of 1/8 inch. Frame shall be reinforced to receive hardware.

Sealants: Sealants shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, multicomponent, Federal Specification: TT-S-227.

DOOR SEALS AND WEATHERSTRIPPING

Doors and frames shall be fitted with door seals or gaskets where indicated, and exterior doors and frames shall be fitted with applied rain drips and weatherstripping on all four sides (entire perimeter of opening) in accordance with applicable requirements of SDI 111.

Weatherstripping and seals shall be non-ferrous, with synthetic rubber edge seals where indicated or required, of type or style appropriate for the purpose. Drips and visible weatherstripping shall be painted out to match doors and frames.

Door seals or gasketing for fire-rated doors and acoustical doors shall be synthetic rubber of type manufactured and appropriate for the purpose.

Coordinate types and scheduling of door seals and weatherstripping and the types of thresholds to be furnished under "Finish Hardware" in section 12-8 "Doors and Windows," of these special provisions.

PART 3 - EXECUTION

INSTALLATION

Doors and frames shall be installed rigidly, securely, plumb and true and in such a manner that the doors operate freely without rubbing or binding. Clearance between frame and door shall be not more than 1/8 inch. The exterior frame shall be sealed weathertight.

Pressed metal frames shall be secured with clips and anchors as shown on the plans.

Fire rated assemblies shall be installed according to the manufacturer's recommendations.

Fire rated assemblies shall include doors, door frames, automatic smoke-actuated closers, self-closing mechanisms, panic hardware, wire glass, and fire rated louvers. Assemblies shall be approved by the California State Fire Marshal.

Painting: Except for the primer application specified herein, doors and frames shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Section 12-9, "Finishes," of these special provisions.

12-8.02 OVERHEAD COILING DOORS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing overhead coiling doors in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data:

Manufacturer's descriptive data, roughing-in diagram and installation instructions for each size and type of door shall be submitted for approval.

Manufacturer's descriptive data shall include door curtain construction and material thickness, door track size and material thickness, counterbalance spring service life and motor operator specifications.

Materials list shall contain all items proposed to be furnished and installed under this section of these special provisions.

Working drawings shall show details of special components and installations which are not fully dimensioned or detailed in manufacturer's descriptive data.

QUALITY ASSURANCE

Single Source: Each sectional door shall be provided as a complete unit produced by one manufacturer, including frames, sections, bracket guides, tracks, counterbalance mechanisms, hardware, operators and installation accessories, to suit opening and head room available.

Wind Loading: Design and reinforce section overhead doors to withstand a 26 pounds per square foot wind load with a midspan deflection not to exceed 1/120 span.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Subject to compliance with the specifications, manufacturers offering products which may be incorporated into the work include, but are not limited to the following: Cookson Company; Cornell Iron Works; McKeon Rolling Door Company, Inc.; Overhead Door Corp.; Raynor; or equal.

MATERIALS

DOOR SECTIONS

Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance size and type of door indicated, and as follows:

Steel Door Curtain Slats At Steel Coiling Doors: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.036 inch (20 gage) and as required to meet design requirements.

Stainless-Steel Door Curtain Slats At Stainless Steel Coiling Doors: ASTM A 666, Type 304; sheet thickness of 0.036 (20 gage) inch and as required to meet design requirements.

1. Style of Slats: Curved-profile design as selected from manufacturer's standards.

2. Insulation: Slats shall be filled with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Insulation shall be filled completely within metal slat faces.

3. Metal interior Curtain -Slat Facing: Match metal of exterior certain- slat face.

Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from metal to match curtain slats and finish.

Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

HOOD

General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

Galvanized Steel: Nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

Stainless Steel: 0.025-inch thick stainless-steel sheet, Type 304, complying with ASTM A 666.

Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

LOCKING DEVICES

Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.

Keys: Provide Minimum three keys for each cylinder, unless otherwise indicated.

CURTAIN ACCESSORIES

Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of hood.

At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene.

Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

Provide pull-down straps or pole hooks for doors more than 84 inches high.

Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:

Building fire-detection and -alarm systems and manufacturer's standard door-holder-release devices.

COUNTERBALANCING MECHANISM

General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

ELECTRIC DOOR OPERATORS

General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

Comply with NFPA 70.

Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

Door Operator Location(s): Operator location indicated for each door.

Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements unless otherwise indicated.

Electrical Characteristics:

Phase: Single phase.
Volts: 120 V.
Hertz: 60.

Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

Speed in first subparagraph below is for standard-speed doors. Consult manufacturer and revise for higher-speed operation.

Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 30 lbf.

Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

METAL FINISHES

Factory Prime Finish on Steel: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

Surface Preparation of Stainless Steel: Remove tool and die marks and stretch lines, or blend into finish.

Polished Stainless Steel Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.

Run grain of directional finishes with long dimension of each piece.

When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

Directional Satin Finish: No. 4.

PART 3 - EXECUTION

INSTALLATION

Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

Fire-Rated Doors: Install according to NFPA 80.

Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

12-8.03 IMPACT DOORS

PART 1 – GENERAL

SUMMARY

This section includes the requirements for monolithically (one piece) formed, insulated, high impact door systems complete with spring bumpers, windows, hardware and accessories.

Related Sections:
Prepared openings with steel channel jambs and header are specified under “Miscellaneous Metals” in Section 12-5 “Metals,” of these special provisions.

SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for impact door system components including frame, hardware, trim, windows, and accessories.

Working Drawings: Provide detailed drawings of the impact doors including installation details, door, hardware and anchor locations, and accessories.

Samples for Initial Selection: Manufacturer's color samples consisting of door panel material showing the full range of colors, textures, and patterns available.

Operation and Maintenance Data: Provide operation and maintenance manual containing printed instructions for operation, adjustment, care, and maintenance of the door and accessories. Manuals shall be consistent with manufacturer's standard brochures, printed instructions, general operating and troubleshooting procedures, and safety precautions.

QUALITY ASSURANCE

Manufacturer's Qualifications: The manufacturer shall be regularly engaged in the design and fabrication of impact door systems for a period of not less than five (5) years. The manufacturer shall be capable of furnishing compatible auxiliary components and accessories shown or specified.

DELIVERY STORAGE AND HANDLING

Deliver doors and accessory items to the site in unopened protective packaging bearing the manufacturer's labels.

Store doors on edge or in upright position in a clean dry environment and cover with suitable weathertight and ventilated covering. Stack doors in a manner to prevent contact with other materials which might cause staining or other surface damage.

PART 2 PRODUCTS

DOOR COMPONENTS

Door Panel: Monolithic, one piece, hollow shell of high impact, cross-linked polyethylene with minimum wall thickness of 1/4-inch, overall panel thickness of 1-7/8 inch and textured finish. Fabricate with integral molded keyways to accept gaskets at bottom, leading and back edges of door panel.

Door Panel Core: High density, foamed-in-place, non-CFC urethane providing an insulating R factor of 10.83 (U factor of 0.092). Underwriters Laboratories certified as having flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with ASTM E-84 and UL-723.

Standard Hinge System: consists of the following components:

1. Upper hinge: self closing "V" cam design; . The roller assembly design shall allow up and down and back and forth adjustments to the door. Upper hinge seal shall be black PVC with a flexible nylon reinforced vinyl skirt.

2. Lower hinge: Pillow block design of ductile iron with ultra high molecular weight (UHMW) polyethylene sleeve and ductile iron lower hinge adapter with provision for mounting an optional spring assist.

3. Hinge Shaft: 1-5/16 inch diameter inserted with screws through tubular steel spine foamed-in-place during fabrication extended full length of door.

Vision Panel: Window glazing shall be 1/8-inch thick polycarbonate with aluminum frame recessed a minimum of 1/8-inch from the face of the panel. Minimum height from finish floor to the bottom of the viewing area shall not exceed 48 inches.

Gaskets: Extruded black thermoplastic vulcanizate fitted into matching, pre-formed gasket key held by friction; hardness: 60 to 80 Shore A Durometer. Provide gaskets wings that seal against rounded edges of the door.

Fully Gasketed: Leading edge shall be blade-type for a double door or bulb-type for a single panel. Provide bulb type gasket on the bottom and between the back of the door and jamb. Provide top seal of coextruded PVC extrusion with flexible PVC gasket.

ACCESSORIES

Provide manufacturer’s standard accessories as follows:

1. Bumpers: polyethylene spring bumpers with 4-inch projection, 24-inch heights high. Color to be selected from manufacturer’s standard.

2. Lower Hinge Guards

3. Double Pane View Windows

FABRICATION

Position back edge steel and gasket extrusions in place and fabricate door panel structure by rotation-mold process. Foam-in-place door core with non-CFC urethane. Trim door and drill and fit with hardware, vision panel, gasketing and required accessory items. Assemble door unit at factory to the fullest extent free from defects and warping.

Tolerances: Width and height of each panel: +/- 1/4 inch.

PART 3 EXECUTION

PREPARATION

For impact doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings showing locations of anchorage devices and similar items.

INSTALLATION

Install doors accurately with clearances, necessary anchors, hardware and accessories in accordance with the approved drawings, manufacturer's printed instructions, and as specified.

ADJUSTING

Follow manufacturer's instructions as required to:
1. Clean and lubricate operating parts.
2 .Adjust to open and close smoothly and freely without binding
3 .Check seals for proper fit.

12-8.04 STOREFRONT ENTRANCES

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing interior and exterior entrance doors and storefront framing in accordance with the details shown on the plans and these special provisions.

Related Work: Glazing shall be as specified in under "Glazing" in Section 12-8 “Doors and Windows,” of these special provisions.

PERFORMANCE REQUIREMENTS

General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

Dimensional tolerances of building frame and other adjacent construction.

Failure includes the following:

1. Deflection exceeding specified limits.
2. Thermal stresses transferring to building structure.
3. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
4. Noise or vibration created by wind and by thermal and structural movements.
5. Loosening or weakening of fasteners, attachments, and other components.
6. Failure of operating units.

Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional Civil or Structural Engineer, using performance requirements and design criteria indicated.

Wind Loads: 20 psf.

Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.

Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.

2. Test Durations: 10 seconds.

3. ASTM E 283 requires using a static-air-pressure difference of 1.57 lbf/sq. ft. unless otherwise indicated, which is equivalent to a 25-mph wind. Static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa) is equivalent to a 50-mph (80-km/h) wind.

Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..

SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for storefront system components including frame, hardware, trim, windows, and accessories. Provide product test reports.

Working Drawings: Provide detailed drawings of the aluminum-framed system including installation details, door, hardware and anchor locations, and accessories.

Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a Civil or Structural Engineer registered in the state of California.

Samples for Initial Selection: Manufacturer's color samples consisting of aluminum material showing the full range of colors, textures, and patterns available.

Operation and Maintenance Data: Provide operation and maintenance manual containing printed instructions for operation, adjustment, care, and maintenance of the door and accessories. Manuals shall be consistent with manufacturer's standard brochures, printed instructions, general operating and troubleshooting procedures, and safety precautions.

Warranties: Sample of special warranties.

QUALITY ASSURANCE

Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

Product Options: Information on the drawings and in the Special Provisions establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

Preinstallation Conference: Conduct conference at Project site unless otherwise required.

WARRANTY

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

Warranty Period: 5 years from date of CompletionProject Completion.

Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

Warranty Period: 5 years from date of Substantial Completion.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Vistawall Architectural Products, CMI Architectural, Kawneer Company, or equal.

MATERIALS

Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
Sheet and Plate: ASTM B 209.

Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

Extruded Structural Pipe and Tubes: ASTM B 429.

Structural Profiles: ASTM B 308/B 308M.

Welding Rods and Bare Electrodes: AWS A5.10.

Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

Structural Shapes, Plates, and Bars: ASTM A 36.

Cold-Rolled Sheet and Strip: ASTM A 1008.

Hot-Rolled Sheet and Strip: ASTM A 1011.

FRAMING SYSTEMS

Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Construction: Thermally broken.

Glazing System: Retained mechanically with gaskets on four sides.

Glazing Plane: As indicated.

Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

Reinforce members as required to receive fastener threads.

Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123 or ASTM A 153.

Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

GLAZING SYSTEMS

Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

ENTRANCE DOOR SYSTEMS

Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

Thermal Construction**:** High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

Coordinate entrance door design in first subparagraph below with hardware requirements. Narrow-stile doors may not accommodate some exit devices.

Door Design: As indicated.

Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

Entrance Door Hardware: As specified under “Finish Hardware” in Section 12-8 “Doors and Windows” of these special provisions.

Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

FABRICATION

Form or extrude aluminum shapes before finishing.

Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

Profiles that are sharp, straight, and free of defects or deformations.

Accurately fitted joints with ends coped or mitered.

Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

Physical and thermal isolation of glazing from framing members.

Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

Provisions for field replacement of glazing from interior.

Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

Entrance Doors: Reinforce doors as required for installing entrance door hardware.

Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

After fabrication, clearly mark components to identify their locations in Project according to Working Drawings.

ALUMINUM FINISHES

Duranar XL meeting AAMA 2605, or Hylar 5000 PVDF.
Color and Gloss: As selected by Engineer from manufacturer's full range.

MISCELLANEOUS ITEMS

Anchors: Anchors shall be manufacturer's standard.

Glazing: Glazing shall conform to the requirements specified under "Glazing," in Section 12-8.08 of these special provisions.

Backer Rod: Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant: Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to Federal Specification: TT-S-227.

PART 3 – EXECUTION

INSTALLATION

General:
Comply with manufacturer's written instructions.

Do not install damaged components.

Fit joints to produce hairline joints free of burrs and distortion.

Rigidly secure non-movement joints.

Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

Seal joints watertight unless otherwise indicated.

Metal Protection:
Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

Set continuous sill members and flashing in full sealant bed to produce weathertight installation.

Install components plumb and true in alignment with established lines and grades, and without warp or rack.

Install glazing as specified under “Glazing” in Section 12-8 "Doors and Windows,” of these special provisions.

Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

FIELD QUALITY CONTROL

Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

Water Spray Test: Before installation of interior finishes has begun, areas designated by Engineer shall be tested according to AAMA 501.2 and shall not evidence water penetration.
Test Area: A minimum area of 75 feet by 1 story of aluminum-framed systems.

Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports.

12-8.05 ALUMINUM WINDOWS

PART 1 – GENERAL

SUMMARY

Scope: This Work shall consist of furnishing and installing aluminum windows in accordance with the details shown on the plans and these special provisions.

Glazing for windows shall be in accordance with the requirements specified under "Glazing" in 12-8, "Doors and Windows," of the Special Provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions and schedule shall be submitted for approval.

Manufacturer's descriptive data and installation instructions shall show window elevations, plan views, full size sections, anchoring details to all substrates, anchors and hardware.

Installation schedule shall show location, size and type for each window.

QUALITY ASSURANCE

Windows shall meet the requirement of NAFS-1, "Voluntary Performance Specification for Windows, Skylights, and Glass Doors," and shall meet the C30 (Commercial) product designation unless otherwise shown on the plans. Windows shall be labeled with the AAMA label.

PART 2 - PRODUCTS

General: Windows shall be commercial (C) grade aluminum prime windows unless otherwise shown on the plans.

Door and Transom Windows: Door and transom windows shall be door or door frame manufacturer's standard window framing, glazing stops and glazing accessories.

Fixed Windows: Fixed windows shall be non-operable glazed panel inserted into a frame to include muntins, glazing stops, and glazing accessories.

Window Type: Fixed.

AAMA/WDMA Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS unless more stringent performance requirements are indicated.

Performance Class and Grade: AW40.

Aluminum: Aluminum shall be extruded 6063-T5 aluminum alloy.

Screws, Fasteners and Window Accessories: Screws, fasteners and window accessories shall be non-corrosive metals compatible with aluminum except guides and rollers may be vinyl and nylon respectively. Finish for locks, operators, strikes, keepers and other metal hardware shall match window finish.

Weatherstripping: Weatherstripping shall be continuous, replaceable type, wool pile mounted in metal or double runs of ultraviolet resistant neoprene or vinyl.

Sealant: Sealant shall be single-component, solvent type acrylic, self-leveling, non-sag, conforming to Federal Specification: TT-S-230.

Tape: Tape shall be compatible with sealant; Pecora, "B-44 Extra-Seal;" Pittsburg Plate Glass, "Duribbon;" Protective Treatment, "PTU 606;" Tremco, "440 Tape;" or equal.

Finishes: Finish for windows shall be Engineerural Class I, Duranar XL or Hylar PVDF finish meeting American Engineerural Manufacturer's Association Standard 2605 unless otherwise shown on the plans.

PART 3 - EXECUTION

FABRICATION

Frame and sash shall be accurately machined and fitted to hairline joinery that develops the members. Joints shall be factory-sealed weathertight.

Sash shall be removable from the interior only. Sash shall have concealed condensation weeps to the outside.

DELIVERY AND STORAGE

Windows shall be delivered in original, unopened, unbroken containers, wrappings, or bags with labels bearing the brand name, name of manufacturer or supplier, standard of manufacture, and product description.

Windows and accessories shall be stored off the ground, kept dry, fully protected from weather and damage

INSTALLATION

Window units shall be set straight, level, plumb and in true alignment in prepared openings. Windows shall be centered in openings. Clearance between the window unit and the building framing shall be from 3/16 inch to ¼ inch at the sides and ½ inch at the top

The installation shall be flashed and sealed weathertight.

All aluminum surfaces in contact with masonry, steel or other incompatible materials shall be isolated with pressure sensitive tape, zinc chromate primer, bituminous paint or such other material recommended by the window manufacturer and approved by the Engineer.

12-8.06 PRESSED METAL FRAMED WINDOWS

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing pressed metal framed windows in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's Data: Manufacturer's descriptive data, working drawings and installation instructions shall be submitted for approval.

PART 2 - PRODUCTS

Framing: Framing shall be pressed metal, not less than 0.060 inch thick (16-gage) with all members square and true, full mitered frame corners and continuous welds at all joints and cover plates. Welds at frame faces shall be ground smooth and flush with surrounding surfaces. All metal surfaces shall be cleaned and factory primed with one coat of metal protective rust inhibitive primer. Primer shall not contain lead type pigments.
Cold-Formed Steel Window Members: Provide frame and ventilator members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653. For combined weight of frame and ventilator members and front-to-back depth of frame or ventilator members, comply with the following requirements:

Anchors: Anchors shall be manufacturer's standard.

Glazing: Glazing shall conform to the requirements specified under "Glazing," in Division 8, "Doors and Windows," of these special provisions.

Backer Rod: Backer rod shall be close cell, non-absorbent, non-staining foam rod compatible with sealant.

Sealant: Sealant shall be ultraviolet and ozone resistant, gun grade polysulfide or polyurethane, single component. Sealant shall conform to Federal Specification: TT-S-227.

PART 3 - EXECUTION

Installation: Frames shall be installed rigidly, securely, plumb and true. Installations shall be sealed watertight and weathertight.

Painting: Except for the primer application specified herein, exposed frame surfaces shall be cleaned, prepared and painted in accordance with the requirements specified under "Painting" in Division 9, "Finishes," of these special provisions.

12-8.07 FINISH HARDWARE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing hardware items for doors in accordance with the details shown on the plans and these special provisions.

Hardware for special doors and frames, if required, shall be as specified under "Hinged Doors" in Section 12-8 "Doors and Windows," of these special provisions.

DESIGN REQUIREMENTS

Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course work for project hardware consultation to Engineer and Contractor.

    a. Responsible for detailing, scheduling and ordering of finish hardware.

Performance Requirements:

1. Hardware: New, free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

2. Exit Door: Operable from inside at all times with single motion without the use of a key or special knowledge or effort.

3. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA 80. This requirement takes precedence over other requirements for such hardware. Hardware UL10C / UBC Standard 7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide only such hardware that has been tested and listed by a nationally recognized testing laboratory for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required for fire-rated openings whether or not listed in the hardware schedule.

    a. Provide hardware listed by nationally recognized testing laboratory for labeled and 20-minute openings in conformance with requirements for class of opening scheduled. Provide label or stamp of nationally recognized testing laboratory on hardware for labeled openings.

    b. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door’s testing laboratory label on exit device indicating "Fire Exit Hardware."

4. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers’ instructions.

    a. Where scheduled item is now obsolete, bid and furnish manufacturer's updated item at no additional cost to the project.

5. Provide hardware with suitable fasteners for complete work.

6. Quantities listed are for the Contractor's convenience; confirm quantities.

7. If the grade of an item designated by ANSI/BHMA designation is not indicated, provide Grade 1.

8. Hand of Door: Contract Drawings show direction of swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

Regulatory Requirements:

1. Locate latching hardware between 30" to 44" above the finished floor, per California Building Code, Section 1133B.2.5.1.

2. Adjust doors to open with not more than 5lbs pressure at exterior doors, interior nonrated at 5 lbs, and 15.0lbs at fire-rated doors, per California Building Code, Section 1133B.2.5.

3. All hardware to meet California Building Code Sections 1133B.2.1, 1133B.2.5.1 and 1003.3.1.8

4. Thresholds: Comply with California Building Code Section 1133B.2.4.1.

5. Floor stops: Do not locate in path of travel. Locate no more than 4" from walls, per DSA Policy No. 99008 (Access).

SUBMITTALS

Manufacturer's technical information and catalog cuts for each item of door hardware and a door hardware schedule shall be submitted for approval prior to installation.

Manufacturer's catalog cuts shall include catalog numbers, material, grade, type, size, function, design, quality and finish of hardware.

The door hardware schedule shall indicate the location and size of door opening, the door and frame material, and the size, style, finish and quantity of the hardware components required.

FINISHES

Hardware shall be provided with standard US 26D satin chromium plated finish except US 32D satin stainless steel for exterior hardware or aluminum sprayed finish where indicated.

KEYING INSTRUCTIONS

New facilities shall have a building master key system established.

Locks shall have cylinders with figure eight interchangeable cores with six pin barrels. Permanent cores and keys shall be delivered to the Engineer for final installation at completion of project.

The Contractor shall also provide figure eight interchangeable cores for use during construction which shall remain the property of the State.

Key bows shall be stamped "State of California" and "Do Not Duplicate."

PART 2 - PRODUCTS

General: Door hardware equal in material, grade, type, size, function, design, quality and manufacture to that specified herein shall be submitted for approval.

Butt Hinges:

1. Butt hinges shall be steel, 1 1/2-pair per door leaf up to 7'-0" high an additional hinge for each 2'-0" above 7'-0" highs. Nonremovable pins shall be provided at outswing exterior doors. Hinge size shall be 4½" x 4½" for up to 3'-0" wide doors and 5" x 4-1/2" for over 3'-0" wide doors. Plain bearing hinge shall be used at doors without closers.

2. Standard weight hinges shall be:

Manufacturer	steel	Stainless steel
Hager	BB 1279	CB1191
McKinney	TB 2714	TA 2314
Stanley	BB 179	FBB 191
or equal.		

3. Heavy weight hinges shall be:

Manufacturer	steel	Stainless steel
Hager	BB 1279	BB1191
McKinney	T4A 3786	TA4 3586
Stanley	BB 179	FBB 199
or equal.		

a. Heavy Duty Hinge With Electric Thru Wire: Where indicated, provide manufacture's electric thru wire only; 3.5 Amp continuous; 16 Amp pulse.

Mortise Locksets, Latchsets and Privacy Sets:

Mortise locksets, latchsets and privacy sets shall be steel case with 1¼" x 8" face plate and 2¾-inch backset. Door and frame preparation for mortise locksets, latchset and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	35H 6FW 15H
Falcon	LM521 DG
Schlage	L9453R x 06
or equal.	

Lever operated latchset:

Best	35H 0N 15H
Falcon	LM101 DG
Schlage	L9010 x 06
or equal.	

Lever operated privacy set:

Best	35H 0L 15H
Falcon	LM311 DG
Schlage	L9040 x 06
or equal.	

Cylindrical Locksets, Latchsets and Privacy Sets:

Cylindrical locksets, latchsets and privacy sets shall be steel chassis, 2 1/8-inch diameter, 2¾-inchbackset. Door and frame preparation for cylindrical lockset, latchsets and privacy sets shall conform to ANSI A115.1.

Lever operated lockset shall be:

Best	93K6 AB 9C
Schlage	D53RD RHO

Exterior lever operated lockset shall have anti-vandal lever.

Lever operated latchset shall be:

Best	93K ON 9C
Falcon	LY101 D
Schlage	D10S RHO
or equal.	

Lever operated privacy set shall be:

Best	93K OL 9C
Falcon	LY301 DG
Schlage	D40S RHO
or equal.	

Cylindrical Dead Locks:

Cylindrical dead locks shall have one-inch throw bolt with concealed hardened steel inserts and one-inch diameter bolt housing, 2¾-inch backset.

Single cylinder dead lock with inside thumb turn shall be:

Best	83T 7K
Falcon	D441
Schlage	B460R
or equal.	

Double cylinder dead lock shall be:

Best	83T 7M
Falcon	D431
Schlage	B462R
or equal.	

Flush Bolts:

Flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. Provide automatic bolts on UL rated pairs of doors.

Flush bolts for manual operation shall be:

Trimco	3915
Glynn Johnson	FB6
H.B. Ives	457
or equal.	

Flush bolts for automatic operation shall be:

Door Control	840
Glynn Johnson	FB7
H.B. Ives	559
or equal.	

Surface Door Closers: ANSI/BHMA 156.4, Grade 1. Heavy-duty arms and knuckles. Full rack and pinion type with removable non-ferrous cover, 1 1/2 inch minimum bore. Place closers inside building, stairs, and rooms. Provide appropriate closer type so that closers are not visible to public view.

1. Closers shall be non-handed, non-sized, adjustable, and multi-size 1 through 6.
2. Drop brackets are required at narrow head rails.
3. Doors closers only on right hand pull leaf of double doors.
4. Separate adjusting valves for closing and latching speed, and backcheck.

Panic Devices:

Rim type panic devices shall be installed at single doors and on the active leaf of pairs of doors, unless indicated otherwise. A vertical rod device shall be provided for the inactive leaf of pairs of doors. Dogging devices shall be omitted at UL rated door openings. Panic devices shall be concealed rod with automatic flush bolts.

Panic devices with outside key operation shall be:

Darma	9100 X08
Monarch	18-C-L
Von Duprin	33A-L
or equal.	

Panic devices – Fire Rated

Darma	F 9100 X08
Monarch	F-18-C-L
Von Duprin	33A-L-F
or equal.	

Pushplates and Pullplates:

Pushplates and pullplates shall be 4" x 16" x 16-gage. Grips shall be one-inch diameter with 1½-inch standoff and 8-inch center to center fastening, unless indicated otherwise.

Pushplates shall be:

Builders Brass	47-E
Quality	40-5
Trimco	1001-3
or equal.	

Pullplates shall be:

Builders Brass	1618-E
Quality	1515
Trimco	1013-3B
or equal.	

Door Protection Plates: BHMA A156.6.

Sizes of Armor Mop and Kick Plates

2 inch less than door width for single doors; one inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors and one inch less than height of bottom rail for panel doors. Provide a minimum 36 inch armor plates for flush doors and completely cover lower panels of panel doors, except 16 inch high armor plates on fire doors. Provide 6 inch mop plates.

Floor Mounted Stops:

Floor mounted stops shall be dome type. The height of the stop shall be determined by the clearance required when a threshold is used or not used.

Stops for openings without thresholds shall be:

Builders Brass	8061
Quality	331
Trimco	1210
or equal.	

Stops for openings with thresholds shall be:

Builders Brass	8063
Quality	431
Trimco	1213
or equal.	

Wall or Door Mounted Door Stop:

Wall or door mounted door stop shall have a 3¾-inch projection and 3-point anchoring.

Wall or door mounted door stop shall be:

Builders Brass	W96
Quality	38
Trimco	1236-1/4-2
or equal.	

Wall Mounted Door Stop and Holder:

Wall mounted door stop and holder shall be:

Builders Brass	W141X
Quality	36/136
Trimco	1207
or equal.	

Wall Bumpers:

Wall bumpers base diameter shall be 2½ inches with a one-inch projection.

Bumpers shall be:

Builders Brass	WC9
Quality	302
Trimco	1270CV
or equal.	

Automatic Door Bottom:

Automatic door bottom shall be heavy duty, full mortise.

Bottom shall be:

Pemko	434 AR
Zero	360
or equal.	

Thresholds, Rain Drips, Door Sweeps And Door Shoes: As scheduled and per details. Comply with CBC Section 1133B.2.4.1.

Manufacturer's: Pemko, Reese, Zero, or equal.

Threshold Bedding Sealant: Threshold bedding sealant shall conform to Federal Specification: SS-C-153.

Door Seals And Weatherstripping:

Doors and frames shall be fitted with door seals or gaskets where indicated, and exterior doors and frames shall be fitted with applied rain drips and weatherstripping on all four sides (entire perimeter of opening) in accordance with applicable requirements of SDI 111.

Weatherstripping and seals shall be non-ferrous, with synthetic rubber edge seals where indicated or required, of type or style appropriate for the purpose. Drips and visible weatherstripping shall be painted out to match doors and frames.

Door seals or gasketing for fire-rated doors and acoustical doors shall be synthetic rubber of type manufactured and appropriate for the purpose.

Acceptable manufacturers shall be Pemko, Reese, Zero, or equal.

Door Signs and Name Plates: Door signs and name plates shall be as specified under "Signs" in Section 12-10, "Specialties," of the special provisions.

Electric Door Strike: Electric door strike shall be Von Duprin 6000 Series, Folger Adams Co. 732-75 Series or equal.

Electromagnetic Door Locks: Electromagnetic door locks shall be electromagnetic locking device capable of at least 1800 pound force and suitable for outdoor use. Electromagnetic lock shall be Securiton Magnalock Series; Schilage Magforce Series, or equal.

PART 3 - EXECUTION

Doors and Frames: Doors and frames shall be set square and plumb and be properly prepared before the installation of hardware.

INSTALLATION

Hardware items shall be accurately fitted, securely applied, and adjusted and lubricated in accordance with the manufacturer's instructions. Installation shall provide proper operation without bind or excessive play.

Hinges shall be installed at equal spacing with the center of the end hinges not more than 9 5/8 inches from the top and bottom of the door. Pushplates and door pulls shall be centered 44 inches from the finished floor. Locksets, latchsets, privacy sets and panic exit mechanisms shall be 40 5/16 inches from the finished floor. Kickplates shall be mounted on the push side of the doors, one inch clear of door edges.

Thresholds shall be set in a continuous bed of sealant material.

Door controls shall be set so that the effort required to operate doors with closers shall not exceed 5 pounds maximum for exterior doors and interior doors. The effort required to operate fire doors may be increased above the values shown for exterior and interior doors but shall not exceed 15 pounds maximum.

Door stops located on concrete surfaces shall be fastened rigidly and securely in place with expansion anchoring devices. Door stops mounted elsewhere shall be securely attached with wood screws or expansion devices as required.

Backing shall be provided in wall framing at wall bumper locations.

The location and inscriptions for door signs and name plates shall be as shown on the plans.

Hardware, except hinges, shall be removed from surfaces to be painted before painting.

Upon completion of installation and adjustment, the Contractor shall deliver to the Engineer all dogging keys, closer valve keys, lock spanner wrenches, and other factory furnished installation aids, instructions and maintenance guides.

DOOR HARDWARE GROUPS AND SCHEDULE

Hardware groups specified herein shall correspond to those shown on the plans:

GROUP 1

1 each	top, intermediate, and bottom offset pivots by door manufacturer, one pivot shall be electrical transfer pivot
1 each	mortise lockset with electric strike
1 each	card reader
1 each	door closer with hold-open arm
1 each	Aluminum threshold
1 each	automatic door bottom
1 each	integral weatherstripping
1 each	kickplate
1 each	floor mounted doorstop

GROUP 2

2 each	top, intermediate, and bottom offset pivots by door manufacturer, one pivot shall be electrical transfer pivot
2 each	Electrical magnetic lock
1 each	card reader
2 each	panic device
2 each	door closer with stop and hold-open arm
2 each	offset pull
1 each	Aluminum threshold
2 each	automatic door bottom
2 each	integral weatherstripping
2 each	kickplate
2 each	floor mounted doorstop

GROUP 3

Butt hinges

1 each	cylindrical lockset with anti-vandal lever on active door, entrance function
1 each	cylindrical deadbolt on active door
1 each	double dummy trim lever on inactive door
1 each	flush bolt on inactive door
2 each	door closer with stop and hold-open arm
1 each	astragal on active leaf
1 each	Aluminum threshold
2 each	automatic door bottom, rain drip
2 each	weatherstripping
2 each	kickplate
2 each	floor mounted doorstop

GROUP 4

Butt hinges

2 each	Electrical magnetic lock
1 each	card reader
2 each	panic device with electric lock and unlock
2 each	door closer with stop and hold-open arm
2 each	offset pull
1 each	Aluminum threshold
2 each	automatic door bottom, rain drip
2 each	weatherstripping
2 each	kickplate
2 each	floor mounted doorstop

GROUP 5

Butt hinges, one hinge with electric transfer hinge

1 each	mortise lockset with electric strike
1 each	card reader
1 each	door closer with hold-open arm
1 each	Aluminum threshold
1 each	automatic door bottom, rain drip
1 each	weatherstripping
1 each	kickplate
1 each	floor mounted doorstop

GROUP 6

Butt hinges

1 each	cylindrical lockset with anti-vandal lever, entrance function
1 each	deadbolt
1 each	door closer with hold-open arm
1 each	Aluminum threshold
1 each	automatic door bottom, rain drip
1 each	weatherstripping
1 each	kickplate
1 each	floor mounted doorstop

GROUP 7

Butt hinges

1 each	mortise lockset, dormitory or entrance function
1 each	door closer
1 each	armor plate, 36” high
1 each	floor mounted doorstop with hold open

GROUP 8

Butt hinges

2 each	panic bar with concealed rod and automatic flush bolt
2 each	mortise lockset, with lever
2 each	door closer with stop and hold open arm
2 each	kickplate
2 each	floor mounted doo rstop with hold open

GROUP 9

Butt hinges
1 each push plate
1 each pull plate
1 each door closer
1 each kickplate
1 each floor mounted doorstop with hold open

GROUP 10

Butt hinges
1 each mortise lockset, privacy or bathroom function
1 each door closer
1 each kickplate
1 each floor mounted doorstop with hold open

GROUP 11

Butt hinges
1 each cylindrical lockset, entrance function
1 each kickplate
1 each wall bumper

GROUP 12

Butt hinges
2 each roller latch with strike
2 each round offset pull
2 each kickplate
2 each floor mounted doorstop with hold open

GROUP 13

Butt hinges
1 each cylindrical locket on active door, entrance function
1 each cylindrical deadbolt on active door
1 each single dummy trim lever on inactive door
1 each flush bolt on inactive door
2 each floor mounted doorstop

GROUP 14

Butt hinges
1 each roller latch with strike
1 each round offset pull
1 each kickplate
1 each floor mounted doorstop

GROUP 15 (1hour rated door)

Butt hinges
1 each mortise lockset, dormitory function
1 each door closer
1 each automatic door bottom
1 each weatherstripping
1 each kickplate

GROUP 16

Butt hinges
1 each cylindrical lockset, entrance function
1 each deadbolt
1 each kickplate
1 each floor mounted doorstop

GROUP 17

Hinge as per gate manufacturer with one self closing hinge
1 each mortise lockset with anti-vandal lever, entrance function
1 each pair of heavy duty stainless steel padlock eyes

GROUP 18

1 each top, intermediate, and bottom offset pivots by door manufacturer
1 each mortise lockset with anti-vandal lever
1 each Aluminum threshold
1 each Automatic door bottom
1 each Integral weatherstripping
1 each kickplate
1 each Floor mounted doorstop

GROUP 19 (1hour rated door)

Butt hinges
2 each panic bar with concealed rod and automatic flush bolt
2 each mortise lockset, with lever
1 each weatherstripping
2 each automatic door bottom
2 each adjustable astragal
2 each kickplate
2 each floor mounted doorstop with hold open

12-8.08 GLAZING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing glazing in accordance with the details shown on the plans and these special provisions.

Glazing shall consist of glass and acrylic sheets for windows, doors and other glazed openings.

PERFORMANCE REQUIREMENTS

All glass shall conform to ASTM Designation: C 1036 and the classifications specified herein and shall be clear glass except as noted.

All polycarbonate sheets shall conform to ASTM Designation: D 702, Type III, Grade 3.

Safety glass shall be furnished and installed at all locations designated in Consumer Product Safety Commission's Safety Standard For Architectural Glazing Materials 16 CFR 1201.

SUBMITTALS

Product Data: A detailed list of glazing materials including glass, sheet, sealants, tapes, setting blocks, shims, compression seals, and glazing channels shall be submitted for approval. The list shall include a schedule of the materials to be used at each location.

LABELS

Each individual pane of heat strengthened or fully tempered glass shall bear an identification label in accordance with ASTM Designation: C 1048.

PART 2 - PRODUCTS

Tempered Glass: Tempered glass shall conform to ASTM Designation: C 1048, Kind FT, Condition A, Type 1, Quality q4 or better.

Wire Glass: Wire glass shall be Type II, Class 1, Form 1, Mesh m1; ¼-inch thick clear polished wire glass with diamond mesh.

Polycarbonate Sheet: Polycarbonate plastic sheet shall be manufacturer's standard sheet complying to ANSI Z97.1 for safety glazing in buildings. Thickness and tint shall be as indicated on the drawings.

Insulating Glass Assemblies: Insulating glass assemblies shall be double pane units consisting of 2 pieces of glass separated by a spacer and hermetically sealed with double seal sealants. The entrapped air shall be at atmospheric pressure and maintained in a hydrated condition by a drying agent located in the spacer.

Exterior Windows.

1. Interior pane shall be coated glass with the following performance:

Transmittance:	Ultraviolet	18 percent
	Visible	73 percent
	Total Solar Energy	38 percent
Reflectance	Visible Light	12 percent
	Total Solar Energy	40 percent
U Value	Winter Night Time	0.29
	Summer Day time	0.28

2. Interior Pane: clear and uncoated

Interior Windows: Interior and exterior panes; clear and uncoated.

Seals, Caulks, Putties, Setting Blocks, Shims, Tapes, Compression Seals, Felt, Spacers, and Channels: Seals, caulks, putties, setting blocks, shims, tapes, compression seals, felt, spacers, and channels shall be top grade, commercial quality, as recommended by the glass or sheet manufacturer and shall conform to the requirements in the publications of the Flat Glass Marketing Association.

PART 3 - EXECUTION

INSTALLATION

Glazing shall conform to the general conditions and applicable details in the publications of the Flat Glass Marketing Association.

Cut edges of tinted glass shall conform to the recommendations of the glass manufacturer. The glazier shall inspect each edge of tinted glass. Panes with edges that do not conform to the manufacturer's standards for tinted glass edges for sunny elevations shall not be used.

Panes shall be bedded fully and evenly, set straight and square within panels in such a manner that the pane is entirely free of any contact with metal edges and surfaces.

For all panes on the exterior of the building, the glazing on both sides of window panes shall provide a watertight seal and watershed. Seals shall extend not more than 1/16 inch beyond the holding members. A void shall be left between the vertical edges of the panes and the glazing channel. Weep systems shall be provided to drain condensation to the outside.

Panes in assemblies using extruded gasket glazing shall be set in accordance with the assembly manufacturer's instructions using gaskets and stops supplied by the manufacturer.

Laminated glass shall be set on setting blocks.

Whenever welding or burning of metal is in progress within 15 feet of glazing materials, a protective cover shall be provided over exposed surfaces.

REPLACEMENT AND CLEANING

All broken or cracked glass and glass with scratches which reduce the strength shall be replaced before completion of the project.

Panes shall be kept clean of cement and plaster products, cleansers, sealants, tapes and all other foreign material that may cause discoloration, etching, staining, or surface blemishes to the materials.

Excess sealant left on the surface of the glass or surrounding materials shall be removed during the work life of the sealant.

Solvents and cleaning compounds shall be chemically compatible with materials, coatings and glazing compounds to remain. Cleaners shall not have abrasives that scratch or mar the surfaces.

The protective covering on acrylic sheet surfaces shall be left until construction is completed or 2 weeks after glazing, whichever is shorter. The covering shall be removed before adhesives dry sufficiently to adhere to the sheet during removal rather than the protective membrane.

Acrylic sheets shall be protected against scuffs, scratches and marring of the surface during construction and any such damaged sheet shall be replaced or restored to like new condition. Restoration work shall conform to the manufacturer's recommendations.

All panes shall be cleaned just before the final inspection. All stains and defects shall be removed. Paint, dirt, stains, labels (except etched labels), and surplus glazing compound shall be removed without scratching or marring the surface of the panes or metal work.

SECTION 12-9 FINISHES

12-9.01 GYPSUM WALLBOARD

PART 1 – GENERAL

Scope: This work shall consist of furnishing, installing and finishing gypsum wallboard in accordance with the details shown on the plans and these special provisions.

Where assembly fire ratings are indicated on the plans, construction shall provide the fire resistance in accordance with the applicable standards in the Fire Resistance Design Manual published by the Gypsum Association.

Wallboard backing for use in restroom and shower areas shall be water-resistant gypsum backing board.

PART 2 - PRODUCTS

Gypsum Wallboard**:** Gypsum wallboard shall conform to ASTM Designation: C 36/C 36M.

Gypsum Backing Board**:** Gypsum backing board shall conform to ASTM Designation: C 442/C 442M.

Water-resistant Gypsum Backing Board**:** Water-resistant gypsum backing board shall conform to ASTM Designation: C 630/C C 630M.

Gypsum Sheathing Board**:** Gypsum sheathing board shall conform to ASTM Designation: C 79/C 79M.

Abuse Resistant Gypsum Sheathing Board: Contain reinforcing fiber mesh, made from 95 percent recycled materials, resist denting - breaking and puncturing, contain no face paper.

Joint Tape and Joint and Finishing Compound**:** Joint tape and joint and finishing compound shall conform to ASTM Designation: C 475.

Corner Beads, Metal Trim and Control Joints**:** Corner beads, metal trim and control joints shall be galvanized steel of standard manufacture.

Resilient Metal Channel**:** Resilient metal channel shall be galvanized sheet steel channels of standard manufacture for reducing sound transmission in wood frame partitions.

Fasteners**:** Fasteners shall be gypsum wallboard nails conforming to ASTM Designation: C 514 or steel drill screws conforming to ASTM Designation: C 1002.

Aluminum Extruded Molding: Aluminum extruded alloy 6063 T5 with clear anodized finish, unless specified otherwise.

PART 3 - EXECUTION

DELIVERY AND STORAGE

Materials shall be delivered in original packages, containers or bundles bearing brand name, applicable standard of manufacture, and name of manufacturer or supplier and shall be kept dry and fully protected from weather and direct sunlight exposure. Gypsum wallboard shall be stacked flat with adequate support to prevent sagging or damage to edges, ends and surfaces.

INSTALLATION

Wallboard panels to be installed on ceilings and soffits shall be installed with the long dimension of the panels perpendicular to the framing members. Wallboard panels to be installed on walls may be installed with the long dimension of the panels either parallel or perpendicular to the framing members. The direction of placing the panels shall be the same on any one wall or partition assembly.

Edges of wallboard panels shall be butted loosely together. All cut edges and ends shall be smoothed as needed for neat fitting joints.

All edges and ends of gypsum wallboard panels shall coincide with the framing members, except those edges and ends which are perpendicular to the framing members. End joints on ceiling and on the opposite sides of a partition assembly shall be staggered.

Except where closer spacings are shown on the plans, the spacing of fasteners shall not exceed the following:

Nails	7 inches
Screws	12 inches
Screws at perimeter of panels for fire resistive assemblies having metal framing	8 inches

Type S steel drill screws shall be used to fasten wallboard to metal framing. Nails or Type W steel drill screws shall be used to fasten wallboard to wood framing. Except as shown on the plans, screws shall not be used in fire resistive assemblies.

Adhesives shall not be used for securing wallboard to framing.

Gypsum wallboard panels shown on the plans for shear wall sheathing or for fire resistive assemblies shall be fastened to all framing members. Gypsum wallboard panels at other locations and gypsum wallboard finish over plywood sheathed shear walls shall be fastened to all framing members except at the following locations:

At internal angles formed by ceiling and walls; ceiling panels shall be installed first with the fasteners terminating at a row 7 inches from the walls, except for walls parallel to ceiling framing. Wall panels shall butt the ceiling panels. The top row of wall panel fasteners shall terminate 8 inches from the ceiling.

At internal vertical angles formed by the walls; fasteners shall not be installed along the edge or end of the panel that is installed first. Fasteners shall be installed only along the edge or end of the panel that butts and overlaps the panel installed first.

Fasteners shall be located at least 3/8 inch from wallboard panel edges and ends. Nails shall penetrate into wood framing at least 1 1/8 inches. Screws shall penetrate into wood framing at least 5/8 inch. All metal fasteners shall be driven slightly below surface level without breaking the paper or fracturing the core.

Metal trim shall be installed at all free edges of panels, at locations where wallboard panels abut dissimilar materials and at locations shown on the plans. Corner beads shall be installed at external corners. Control joints shall be installed at the locations shown on the plans.

Joints between face panels, the internal angles formed by ceiling and walls and the internal vertical angles formed by walls shall be filled and finished with joint tape and at least 3 coats of joint compound. Tape in the corners shall be folded to conform to the angle of the corner. Tape at joints and corners shall be embedded in joint compound.

Dimples at nail and screw heads, dents, and voids or surface irregularities shall be patched with joint compound. Each patch shall consist of at least 3 coats and each coat shall be applied in a different direction.

Flanges of corner beads, control joints and trim shall be finished with a least 3 coats of joint compound.

Each coat of joint compound shall be feathered out onto the panel surface and shall be dry and lightly sanded before applying the next coat. The finished surfaces of joint compound at the panel joints, internal angles, patches and at the flanges of trim, corner beads and control joints shall be flat and true to the plane of the surrounding surfaces and shall be lightly sanded.

Good lighting of the work area shall be provided during the final application and sanding of the joint compound.

Gypsum wallboard used as backing boards for tile or rigid sheet wall covering or wainscotting shall be water resistant. Joints in backing board shall not be taped or filled and dimples at the fastener heads shall not be patched. Edges of cuts and holes in backing board shall be sealed with a primer or sealer that is compatible with the wall covering or wainscotting adhesive to be used.

Surfaces of wallboard to be textured shall receive an orange peel texture, unless otherwise shown on the plans.

12-9.02 CERAMIC TILE

PART 1 - GENERAL

SUMMARY

Scope**:** This work shall consist of furnishing and installing ceramic tile in accordance with the details shown on the plans and these special provisions.

Ceramic tile shall include glazed wall tile, patterned porcelain tile, matte porcelain tile, textured porcelain tile, polished porcelain tile, trim tile, setting materials, grouts and such other materials as maybe required for a complete installation.

SUBMITTALS

Product Data**:**

Manufacturer's descriptive data, a list of materials to be used, and installation instructions for all materials required for the work shall be submitted for approval.

Manufacturer's descriptive data shall be submitted for each type of tile, mortar bed materials, bond coat materials and additives, and grout materials and additives.

Materials list and installation instructions shall include all products and materials to be incorporated into the work.

Friction reports shall be submitted for tile products to be used on floors and other pedestrian surfaces.

Samples**:** Samples shall include five individual samples of each type and color of tile and trim to be installed and shall be of the same size, shape, pattern and finish as the tile and trim to be installed.

QUALITY ASSURANCE

Single Source Responsibility**:** Each type and color of tile, grout and setting materials shall be obtained from a single source.

Master Grade Certificates**:** Each shipment of tile to the project site shall be accompanied by a Master Grade Certificate issued by the tile manufacturer.

Certificates of Compliance**:** Certificates of compliance shall be furnished for bond coat materials, setting bed materials and grout in accordance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

DELIVERY, STORAGE AND HANDLING

Delivery**:** Tile and packaged materials shall be delivered to the job site in sealed, unbroken, unopened containers with the labels intact. Tile containers shall bear the Standard Grade label.

Storage and Handling**:** Materials shall be stored and handled in such a manner as to prevent damage or contamination by water, freezing or foreign matter.

PROJECT CONDITIONS

Protection**:** Tile work shall be protected and environmental conditions maintained during and after installation to comply with the reference standards and manufacturer's printed instructions.

Temperatures**:**

Unless otherwise specified in the manufacturer's installation instructions, the ambient temperature shall be maintained at not less than 50°F nor more than 100°F in tiled areas during installation and for 7 days after completion. Exterior work areas shall be shaded from direct sunlight during installation.

Tile shall not be installed when the temperature of the substrate is greater than 90°F or is frost covered.

Illumination**:** Interior work areas shall be illuminated to provide the same level and angle of illumination as will be available during final inspection.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers**:** Subject to compliance with the specifications, tile shall be American Olean Tile Co., Inc.; Crossville; or equal.

GENERAL

Ceramic Tile**:**

Ceramic tile shall conform to the requirements in ANSI Standard: A137.1, "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Ceramic tile shall conform to the "Standard Grade" requirements.

Tile Installation Materials**:** Tile installation materials shall conform to the requirements in ANSI standard referenced with products and materials indicated for setting and grouting.

Slip Resistant Tile**:** Slip resistant tile shall have sufficient abrasives added such that the static coefficient of friction, wet or dry, shall be not less than 0.6 for walking surfaces and 0.8 for ramps when tested in accordance with ASTM Designation: C 1028.

TILE PRODUCTS

Glazed Porcelain Wall Tile**:**

Glazed wall tile shall be machine made, porcelain clay , and shall have a glossy glaze finish, plain face, and cushion edges. Tile shall be 5/16-inch nominal thickness.

Ceramic tile trim shall match material, size and finish of field tile. Free edges of tiled areas of walls shall have bullnose type trim. Outside corners shall have bullnose type runner trim (not beads). Reentrant corners shall have cove type trim.

Patterned Porcelain Tile:

Patterned porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay. Tiles shall have less than 0.5 percent water absorption and be suitable for exterior use. Tiles shall be 3/8 inch nominal thickness. Patterned porcelain shall be slip resistant.

Matte Porcelain Tile:

Matte porcelain tile shall be machine made, unpolished, dust pressed natural porcelain clay and shall have a plain face. Tile shall have a nominal thickness of 5/16 inch. Matte porcelain tile shall be slip resistant.

Matte porcelain trim tile shall include cove type base at walls and single piece intersecting cove base at corners.

Polished Porcelain Tile: Polished porcelain tile shall be machine made, dust pressed natural porcelain clay. Tile shall have less than 0.5 percent water absorption and be suitable for exterior use. Tile shall have a glossy polished finish and plain face. Tiles shall have a nominal thickness of not less than 5/16 inch.

SETTING MATERIALS

Portland Cement Mortar Installation Materials: Materials for portland cement mortar installation shall conform to the requirements in ANSI Standard: A108.1 as required for installation method designated, unless otherwise indicated.

Elastomeric Dry-Set Mortar (Exterior Applications): Provide elastomeric modified setting motar at exterior tiled areas of the project.

Membrane: Membrane shall be asphalt impregnated felt conforming to ASTM Designation: D 226, Type I, or polyethylene film conforming to ASTM Designation: C 171, Type 1.1.2. Polyethylene film shall not be less than 4 mils thick.

Reinforcement: Reinforcement shall be galvanized welded wire fabric with 2" x 2"-W0.3 x W0.3 conforming to ASTM Designations: A 82 and A 185 except for minimum wire size. Reinforcement shall be provided in flat sheets.

Metal Lath: Metal lath shall be self furring, galvanized, conforming to ASTM Designation C 847, flat expanded type weighing not less than 2.5 pounds per square yard. Factory assembled metal lath and paper backing may be used where reinforcement over paper is shown on the plans.

Tile Bond Coat:

Tile bond coat shall be latex-portland cement bond coat.

Latex-portland cement mortar bond coat shall be a prepackaged mortar mix, conforming to ANSI Standard: A118.4, incorporating a dry acrylic resin, and to which only water is added at the job site. Mortar shall be suitable for exterior use and be labeled for the type of tile to be installed.

Epoxy Bond Coat: Epoxy bond coat shall be a 3 part prepackaged epoxy mortar conforming to ANSI Standard A118.3, suitable for exterior use. Mortar shall be labeled forthe type of tile to be installed.

GROUTING MATERIALS

Tile Grout:

Tile grout shall be latex-portland cement grout.

Latex-portland cement grout shall be a prepackaged grout mix, conforming to ANSI Standard: A118.6, incorporating a dry acrylic resin, and to which only water is added at the jobsite. Grout shall be suitable for exterior use and labeled for the type of tile to be installed.

Epoxy Grout: Epoxy grout shall be 2 part prepackaged epoxy grout conforming to ANSI Standard A118.3 and suitable for exterior use. Grout shall be labeled for the type of tile to be used.

Grout Pigment: Grout pigment shall be chemically inert, fade resistant mineral oxide or synthetic type. Color shall be as shown on the plans.

SEALANTS

Sealant:

Sealant for vertical expansion joints shall be a medium modulus silicone or polyurethane. Sealant for horizontal joints shall be a 2-part polyurethane type material with a Shore Hardness of 35 to 45.

Color of exposed sealants shall match color of grout in tile adjoining sealed joints.

MORTAR BEDS

Cement Mortar Bed:

Cement mortar bed for walls shall be proportioned of one part cement, ½ part hydrated lime, 6 parts damp sand by volume and only enough water to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than ¾ inch in thickness.

Cement mortar bed for floors shall be proportioned of one part cement, 1/10 parts hydrated lime, 5 parts damp sand by volume and only enough water added to provide the necessary workability. Ingredients shall be dry mixed, water added, and materials blended to produce a stiff mix. Mortar bed shall be not less than 1¼ inches in thickness.

MISCELLANEOUS MATERIALS

Sand: Sand shall be a natural or manufactured sand conforming to ASTM Designation: C 144, except that no more than 10 percent shall pass the No. 100 sieve.

Sealers:

Sealer for unglazed quarry tile shall be water repellent, clear solution of ammonium cementitious compound, silicone base material, or other commercially manufactured sealer.

Sealer for grout shall be a penetrating proprietary compound designed for sealing grout. Silicone sealers shall not be used.

Cement: Cement shall conform to ASTM Designation: C 150, Type I.

Hydrated Lime: Hydrated lime shall conform to ASTM Designation: C 206, Type S, or ASTM Designation: C 207, Type S.

Water: Water shall be clean and potable.

Metal Edge Strips: Metal edge strips shall be stainless steel terrazzo strips, 1/8 inch wide at top edge with integral provision for anchorage to mortar bed or substrate.

Cementitious Tile Backer Board: Cementitious backer board shall be a backing and underlayment panel composed of a concrete core with glass mesh reinforcing on both faces and conforming to the requirements of ANSI Standard: A118.9.

MIXING MORTAR AND GROUT

Mixing: Mortar and grout shall be mixed to comply with the requirements of referenced standards and manufacturers for accurately proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, and other procedures need to produce mortars and grout of uniform quality with optimum performance characteristics for application intended.

PART 3 - EXECUTION

PREPARATION

Concrete, mortar, or masonry substrate surfaces which are to receive a mortar bed shall not vary more than ¼ inch in 8 feet from the required plane and shall be true, plumb at vertical surfaces, and square at intersection edges.

Surfaces to receive a mortar setting bed or a bond coat shall be cleaned adequately to assure a tight bond to the applied material. Such cleaning shall leave the surface thoroughly roughened and free from laitance, coatings, oil, sand, dust and loose particles.

The cleaned surfaces which are to receive a mortar bed shall be saturated with water just prior to placing mortar or the cleaned surfaces shall be coated with fresh neat cement slurry. If the surface is saturated with water, excess water shall be removed and the wetted surfaces uniformly dusted with portland cement. The slurry or wetted cement dust shall be broomed to completely coat the surface with a thin and uniform coating just prior to placing the mortar.

Substrates shall be inspected to insure that grounds, anchors, plugs, recessed frames, bucks, drains, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of the tiles.

INSTALLATION

Tile installation shall conform to applicable parts of ANSI 108 Series of the tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" and Tile Council of American, "Handbook for Ceramic Tile Installation."

All tile shall be installed on a bond coat over a setting bed. The setting bed shall be a cured cement mortar bed or a prepared, dimensionally stable substrate of concrete, masonry, cementitious backer board, or other cementitious material. Porcelain tile shall be back buttered before setted.

The back face of the tile shall be free of paper, adhesives, fiber mesh, resins, or other materials affecting the bond of the tile to the bedding material.

Tile sheets shall have permanent edge bonding or temporary mounting materials on the exposed face. Water soluble or absorbent adhesives shall not be used for edge bonding. Temporary mounting materials shall allow observation during tile setting operations.

Tile work shall extend into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as shown on the plans. Work shall be terminated neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Intersections and returns shall be accurately formed. Cutting and drilling of tile shall be performed without marring visible surfaces. Cut edges of tile abutting trim, finish or built-in items shall be carefully ground to produce straight aligned joints. Tile shall be closely fit to electrical outlets, piping, fixtures and other penetrations such that plates, collars, or covers overlap the tile.

Mortar Bed Placement:

The mortar bed, with or without reinforcement as shown on the plans, shall be placed, consolidated, and finished to the required thickness.

The surface of the mortar bed shall be true and pitched as shown on the plans, without high or low spots. The mortar bed surface shall not vary more than 1/8 inch in 8 feet from a plane parallel to the finished tile surface when tile is installed on a cured mortar bed.

In no case shall the allowed tolerances result in offsets between adjoining tiles, low spots on finished tile surfaces than can pond water, or finished tile surfaces that are not plumb or not true.

Cement mortar beds to receive a tile bond coat shall be damp cured under cover for a minimum of 48 hours at a temperature of not less than 70°F.

Cementitious Backer Board: Cementitious backer board shall be installed in accordance with the provisions of ANSI Standard: A118.11.

Tile Bond Coat:

The tile bond coat mortar shall be mixed according to the manufacturer's recommendations. The consistency of the mixture shall be such that ridges formed with the recommended notched trowel shall not flow or slump. Reworking will be allowed provided no water or materials are added. The setting bed surfaces shall be dampened before placing the bond coat as necessary tile installation, but the setting bed shall not be soaked. The setting bed surfaces for epoxy bond coat shall be dry.

The bond coat shall be floated onto the cured mortar bed surface with sufficient pressure to cover the surface evenly with no bare spots. The surface area to be covered with the bond coat shall be no greater than the area that can be tiled while the bond coat is still plastic. The bond coat shall be combed with a notched trowel as recommended by the manufacturer within 10 minutes before installing tile. Tile shall not be installed on a skinned over bond coat.

Elastomeric Dry-Set: Install tiles with elastomeric modified dry-set in accordance with procedures in the TCA Handbook for application indicated. At construction and control joints, follow procedures specified in section EJ 171 of the TCA Handbook and ANSI A108.5.

Installing Tiles:

Tile shall be installed in accordance with the manufacturer's instructions and shall be set solid and shall be well bonded to the substrate.

Tile set on a tile bond coat shall be installed in accordance with ANSI Standard: A108.5, and tile set on an epoxy mortar shall be installed in accordance with ANSI Standard: A108.6.

If tiles are cut, the cuts shall be made with saws. Cut edges shall be rubbed with an abrasive stone to bring the edge of the glaze slightly back from the body of the tile. Cuts shall be accurately made to neatly fit the tile in place. Cut edges shall not be butted against other tile. Cut tile shall be at least half the size of a full size tile.

Tile shall completely cover wall areas behind mirrors and fixtures.

Tile shall be installed so that the finished tile surface does not vary more than 1/8 inch in 8 feet from the finished tile surface shown on the plans. In no case shall there be offsets in adjoining tiles, low spots on finished tile surfaces that can pond water, or finished tile surfaces that are not plumb or true in the completed tile work.

Tiles shall be firmly pressed into the freshly notched bond coat. Tile on interior surfaces shall be tapped and beat into a true surface and to obtain at least 80 percent coverage by the mortar on the back of each tile. Tile on exterior surfaces shall have 100 percent coverage and shall be back-buttered immediately prior to setting the tile.

If tile is face mounted, the paper and glue shall be removed within one hour after tile is installed and all tiles that do not meet the requirements for joints and surface tolerance shall be adjusted or replaced.

Mortar that exudes into the grout spaces between tiles shall be removed to the bottom of tile.

Joints: Joints between tile shall be continuous both vertically and horizontally. Joints shall be straight and of uniform and equal width. Where tiles on adjoining surface are the same size, the joints shall align, one with the other. Joint width shall be as recommended by the tile manufacturer.

Grouting Tile:

Grout shall be mixed, applied and cured in accordance with the manufacturer's recommendations and ANSI Standard: A108.10 for cement grout and ANSI Standard: A108.9 for epoxy grout.

Spacers, strings, ropes, pegs, glue, paper, and face mounting material shall be removed before grouting. Joints between glazed wall tile shall be wetted if they have become dry. Joints for epoxy mortar shall be dry.

Grouting shall not begin until at least 48 hours after installing tile.

A maximum amount of grout shall be forced into the joints between tiles in accordance with the manufacturer's recommendations. The grout shall be finished to the depth of the cushion for cushion edge tile and finished flush with the surface for square edge tile. All gaps and skips in the grout spaces shall be filled.

Mortar or mounting mesh shall not show through the grouted joints.

The finished grout shall have a uniform color and shall be smooth without voids, pinholes or low spots.

Expansion joints shall be kept free of grout or mortar.

Grout shall be protected from freezing or frost for a least 5 days after installation.

Expansion Joints:

Expansion joints shall be installed at the perimeter of all tile floors and at all substrate control joints and changes in the substrate material. Exterior expansion joint spacing shall not exceed 16 feet in any direction.

All expansion joints shall be made with sealant over backer rods. The thickness of sealant at the center of expansion joints shall not exceed the width of the joint. Joint edges shall be primed as recommended by the sealant manufacturer.

Edge Strips: Edge strips shall be installed at openings where the threshold has not been shown on the plans, but where tile floor abuts other flooring materials at the same level. Edge strips shall be installed centered under the closed door, or where there is no door, centered in the opening.

Sounding Tile: Tiled surfaces shall be sounded with a metal bar or chain for improperly bonded tile or setting bed. Tile or setting bed that emits a hollow sound shall be replaced.

Replacement: Cracked, chipped, broken, or otherwise defective tiles shall be removed and replaced. All tiles which differ more than 1/16 inch in elevation from adjacent tile edges shall be removed and replaced.

Curing:

After the installation of tile and the grouting of joints, the tile and grout shall be cured by keeping the surface continuously damp for at least 72 hours after grouting. Curing materials shall not stain the tile or grouted joints. Curing methods shall not erode away the grout.

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours.

CLEANING AND PROTECTION

Cleaning Tile Surfaces:

All exposed tile surfaces shall be cleaned of all grout haze upon completion of grouting. Acids and chemicals used to clean tile shall conform to the tile manufacturer's recommendations. Cleaners shall not be harmful to materials on surfaces of abutting floors, walls, and ceilings. Tile work shall be rinsed thoroughly with clean water before and after using acid or chemical cleaners. After cleaning and rinsing, tile surfaces shall be polished using a soft cloth.

Tile work shall be cleaned and polished again immediately prior to completion of the contract. All dirt, grime, stains, paints, grease, and other discoloring agents or foreign materials shall be removed.

Protection:

After grouting, horizontal tiled surfaces shall be closed to traffic, and all tiled surfaces shall be kept free from impact, vibration or shock, for at least 72 hours after.

Tile surfaces damaged by construction operations shall be retiled.

SCHEDULES

Wall Tile:

Wall tile shall be nominal 3"x 3" wall tile.

Exterior tile shall be nominal 12" x 12".

Installation on mortar bed, using a tile bond coat and grout, shall conform to the requirements of Method W 222, "Handbook for Ceramic Tile Installation."

Installation on gypsum wallboard, using a tile bond coat and grout, shall conform to the requirements of Method W 243, "Handbook for Ceramic Tile Installation."

Installation on cementitious backer board, using a tile bond coat and grout, shall conform to the requirements of Method W 244, "Handbook for Ceramic Tile Installation."

Installation on concrete and masonry shall be on a mortar bed using tile bond coat and grout, and shall conform to the requirements of Method W 211, "Handbook for Ceramic Tile Installation.

Floor Tile: Floor tile shall be as indicated matte porcelain tile installed on a mortar bed using a tile bond coat and grout and shall conform to the requirements of Method F 112, "Handbook for Ceramic Tile Installation." See "Finish Schedule" on the plans for locations.

12-9.03 RESILIENT FLOORING

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing resilient flooring in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, color and pattern samples shall be submitted for approval. Samples of tile shall be 24" x 24" in size.

PROJECT CONDITIONS

Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

Until project completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

Close spaces to traffic during floor covering installation.

Close spaces to traffic for 48 hours after floor covering installation.

Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

Unbacked Rubber Sheet Floor Covering: ASTM F 1859.

1. Type: Type I (homogeneous rubber sheet).

2. Thickness: 1/16 inch.

Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240.

Wearing Surface: Smooth.

Sheet Width: As standard with manufacturer or 6 feet.

Seaming Method: Standard .

INSTALLATION MATERIALS

Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by manufacturer to suit flooring and substrate conditions indicated.

Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

PART 3 - EXECUTION

EXAMINATION

Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

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 floor tile.

PREPARATION

Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Concrete Substrates: Prepare according to ASTM F 710 “Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.”

Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

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.

APPLICATION

Comply with manufacturer's written instructions for installing flooring.

Lay out flooring from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

Lay flooring square with room axis.

Match flooring material for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

Lay flooring with grain running in one direction.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

Extend flooring into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

CLEANING AND PROTECTION

Comply with manufacturer's written instructions for cleaning and protection of floor tile.

Perform the following operations immediately after completing floor tile 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.

4. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

12-9.04 RESILIENT BASE

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing resilient base in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, color palette, and samples of resilient base shall be submitted for approval. Samples shall be not less than 2 inches in length.

PART 2 - PRODUCTS

Resilient Base: Resilient base shall be manufacturer's best grade, rubber base, with premolded internal and external corner pieces. The height and color shall be as shown on the plans.

Adhesive: Adhesive shall be as recommended by base manufacturer.

PART 3 - EXECUTION

INSTALLATION

Bases shall be firmly and totally attached to walls with adhesive and shall be accurately scribed to trim, molding and cabinets. All joints shall be tight fitting. Bases between premolded corners or other termini may be installed continuous or installed using 4-foot minimum standard manufactured lengths. Filler pieces shall be not less than 18 inches.

12-9.05 CARPETING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing carpeting, carpet cushion, adhesives and accessories in accordance with the details shown on the plans and these special provisions.

Carpeting and carpeting materials shall be rated by the manufacturer as suitable for heavy pedestrian traffic and as suitable for use under chairs with casters.

SUBMITTALS

Product Data: Manufacturer's descriptive data for carpet, carpet cushion and adhesives, standard color and pattern line and installation instructions for all materials shall be submitted for approval.

Samples: Carpet colors will be selected from the manufacturer's standard color and pattern line by the Engineer. After the color and pattern have been selected, five (5) sample of carpet and carpet cushion at least 24" x 24" in size shall be submitted for approval.

QUALITY ASSURANCE

Single Source Responsibility: Materials shall be produced by a single manufacturer for each type of carpet.

DELIVERY, STORAGE AND HANDLING

Delivery: Materials shall be delivered to the job site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number.

Storage: Materials shall be stored in original undamaged packages and containers inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PROJECT CONDITIONS

Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

Environmental Limitations: Do not install carpet and carpet cushion until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

MAINTENANCE

Maintenance Instructions: Contractor shall furnish the manufacturer’s instructions for maintenance of the installed work, including methods and frequency recommended for maintaining optimum condition under anticipated traffic and use conditions.

Extra Materials: After completion of the work, not less than 2 percent of each type and color of carpet, as well as usable scraps, shall be delivered to the Engineer at the jobsite. Accessories shall be furnished to properly complete the installation.

PART 2 - PRODUCTS

TUFTED CARPET

Material Properties shall be as follows:

Property	Pile Characteristic	
	Tufted Graphics Loop	Tufted Textured Loop
Fiber Content	100 percent nylon Type 6, 6 of Manufacturer's blend	100 percent nylon Type 6, 6
Density:	6545	6960
Pile Thickness	.143 inch for finished carpet per ASTM D 6859	.208 inch for finished carpet per ASTM D 6859.
Stitches	10 per inch	12 per inch.
Gage	1/8	1/10 ends per inch.
Face Weight	26 oz./cu. yd	26 oz./cu. yd
Total Weight	Per Manufacturer	Per Manufacturer
Primary Backing	Woven polypropylene	Woven polypropylene
Secondary Backing	Woven polypropylene	Woven polypropylene
Backcoating	Manufacturer's standard material	Manufacturer's standard material
Applied Soil-Resistance Treatment	Woven polypropylene	Manufacturer's standard material

Performance Characteristics: As follows:

Characteristic	Performance Requirement
Flammability: Smoke Density Radient Panel	 NFPA 258, ASTM 662: 450 or less ASTM E-648: Passes Class 1
Dry Breaking Strength	Not less than 100 lbf per ASTM D 2646.
Colorfastness to Light:	Not less than 4 after 40 AFU (AATCC fading units) per AATCC 16, Option E.
Electrostatic Propensity:	Less than 3 kV per AATCC 134.
VOC Limits: Provide carpet that complies with the following limits for VOC content when tested according to ASTM D 5116:	Total VOCs: 0.5 mg/sq. m x h. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h. Formaldehyde: 0.05 mg/sq. m x h. Styrene: 0.4 mg/sq. m x h.

Cushion: Cushion shall be closed cell foamed rubber sheet, made from styrene-butadiene rubber (SBR), not less than 5/32 inch thick, weighing not less than 62 ounces per square yard with a top and bottom facing which will prevent liquid from being absorbed into the cushion.

INSTALLATION ACCESSORIES

Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by cushion manufacturer.

Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:

Total VOCs: 10.00 mg/sq. m x h.
Formaldehyde: 0.05 mg/sq. m x h.
2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

PREPARATION

Surfaces to receive carpet shall be free of cracks, localized depressions and bumps. Bumps shall be ground flat, holes, depressions and cracks shall be filled with leveling compound or crack filler.

Prior to installation of carpeting, the surface shall be dry broomed clean and free from paint, oil grease, mortar, plaster droppings, wax or other materials that will interfere with the adhesives.

New concrete shall be cured for not less than 30 days and free from parting or curing compound which interfere with the adhesives. Concrete surfaces shall be checked for dusting. Sealer shall be applied to dusting concrete surfaces.

Carpet, carpet cushion and adhesives shall be stored at a temperature not less than 65°F and a humidity not more than 65 percent for not less than 24 hours. Locations where carpet is to installed shall be maintained between 65°F and 90°F for not less than 72 hours prior to and for 5 days following installation.

INSTALLATION

Applying Primer or Sealer: Primer or sealer, when recommended by the manufacturer, shall be thoroughly brushed on the surface as recommended by the adhesive manufacturer and shall be thoroughly dry prior to application of adhesives.

Installing Cushion:

Cushion shall be installed onto a continuous film of adhesive. Adhesive shall be applied in accordance with the manufacturer’s instruction. Cushion shall be installed in the longest length possible with consideration for traffic patterns and seam placement. Cushion seams shall be at right angles to the carpet seams and not directly under carpet seams.

When cushion adhesive is tacky, place cushion onto the adhesive and adjust as necessary to insure there is no gap at seams and full contact is made with adhesive. Air bubbles shall be smoothed out to provide a level surface.

Installing Carpet:

Carpet installation, seaming techniques and seaming cement shall be in accordance with the carpet manufacturer's recommendation.

Carpet shall be spread full width on cushion for 24 hours prior to installation.

Seam edges shall be trimmed using appropriate seam cutting tools prior to applying adhesives. Seams shall not be cut where cutting tools will penetrate the carpet cushion.

Carpet adhesive shall be spread uniformly over the cushion in accordance with the manufacturer's instructions. After sufficient time, carpet shall be firmly pressed into the adhesive using a roller weighing approximately 50 pounds to ensure carpet has full contact with adhesive. Carpet shall be rolled in both directions.

Carpet shall be installed wall to wall in continuous lengths and widths as wide as possible; cut edges shall be trued and appropriately treated to form non-raveling seams where exposed. Excess carpet shall be trimmed to the wall using a wall trimmer adjusted to net trim.

Where carpet patterns or floor finish between rooms differ, pattern or material break shall occur at centerline of common wall; at door openings, the break shall occur at centerline of closed door.

Edger strips shall be installed at free edges.

CLEANING

Debris and unusable scraps shall be removed and disposed of. Carpet shall be vacuumed using commercial machine with face-beater element.

Soiled spots, excessive adhesive or other unsightly material on the carpet shall be removed in accordance with the carpet manufacturer's recommendations. Where spots cannot be removed, carpet shall be replaced. Protruding face yard shall be trimmed using sharp scissors.

PROTECTION

The Contractor shall protect the carpet from heavy traffic or wear for 24 hours after completion of installation.

Contractor shall provide protective methods and materials as needed to ensure that carpeting will be without deterioration or damage at time of project completion.

12-9.06 PAINTING

PART 1 - GENERAL

Scope: This work shall consist of preparing surfaces to receive coatings, and furnishing and applying coatings, in conformance with the schedules and details shown on the plans and these special provisions.

The coatings specified in this section are in addition to any factory finishes, shop priming, or surface treatment specified elsewhere in these special provisions.

DEFINITIONS

Detergent Wash: Removal of dirt and water-soluble chemicals by scrubbing with a solution of detergent and water, and removal of all solution and residues with clean water.

Hand Cleaning: Removal of dirt, loose rust, mill scale, excess base material, filler, aluminum oxide, chalking paint, peeling paint, or paint that is not firmly bonded to the surfaces by using hand or powered wire brushes, hand scraping tools, power grinders, or sandpaper and removal of all loose particles and dust prior to coating.

Mildew Wash: Removal of mildew by scrubbing with a solution of detergent, hypochlorite-type household bleach, and warm water, and removal of all solution and residues with clean water.

Abrasive Blasting:

Removal of loosely adhering paint, dirt, rust, mill scale, efflorescence, weak concrete, or laitance, shall be by the use of airborne abrasives. Loose particles, dust, and abrasives shall be removed by blasting with clean, oil-free air.

Abrasives shall be limited to mineral grit, steel grit, or steel shot, and shall be graded to produce the surface profile recommended in the manufacturer's data sheet.

Steam Cleaning: Removal of oil, grease, dirt, or other foreign matter by using steam generated by commercial steam cleaning equipment, from a solution of water and steam cleaning compounds, and removal of all residues and cleaning compounds with clean water.

TSP Wash: Removal of oil, grease, dirt, paint gloss, and other foreign matter by scrubbing with a solution of trisodium phosphate and warm water, and removal of all solution and residues with clean water.

Water Blasting: Removal of dirt, loose scale, chalking, or peeling paint by low-pressure water cleaning. Water blasting shall be performed in conformance with the requiremets in SSPC-SP12 and shall produce a surface cleanliness meeting the requirements of SSPC-SP12-WJ4. Equipment used shall have a minimum flow rate of 1.5 GPM. If a detergent solution is used, it shall be biodegradable and shall be removed from all surfaces with clean water.

Protection:

The Contractor shall provide protective devices, such as tarps, screens or covers, as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations.

Paint or paint stains on surfaces not designated to be painted shall be removed by the Contractor at the Contractor's expense and the original surface shall be restored.

SUBMITTALS

Manufacturer's descriptive data, a materials list, and color samples shall be submitted for approval.

Product descriptive data shall include product description, manufacturer's recommendations for product mixing, thinning, tinting, handling, site environmental requirements, product application, and drying time.

Materials list shall include manufacturer's name, trade name, and product numbers for each type coating to be applied.

Color samples shall be manufacturer's color cards, approximately 2" x 3", for each color of coating shown on the plans. Color samples for stains shall be submitted on wood of the same species, color, and texture as the wood to receive the stain.

QUALITY ASSURANCE

Certificates of Compliance: Certificates of Compliance shall be furnished when products are required to conform with the requirements of The Society for Protective Coatings (SSPC) in conformance with the requirements specified in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications.

REGULATORY REQUIREMENTS

Coatings and applications shall conform to the rules for control of Volatile Organic Compound (VOC) emissions adopted by the air quality control district in the air basin in which the coatings are applied.

SITE ENVIRONMENTAL REQUIREMENTS

Coatings shall be applied in conformance with the environmental constraints specified in the manufacturer's printed instructions. These conditions shall be maintained until the coating has cured and is ready for recoat.

Continuous ventilation shall be provided during application of the coatings.

Adequate lighting, as determined by the Engineer, shall be provided while surfaces are being prepared for coatings and during coating applications.

DELIVERY, STORAGE, AND HANDLING

Products shall be delivered to the site in sealed, labeled containers and stored in a well-ventilated area at an ambient air temperature of not less than 45°F. Container labeling shall include manufacturer's name, type of coating, trade name, color designation, drying time, and instructions for tinting, mixing, and thinning.

MAINTENANCE STOCK

Upon completion of coating work, a full one-gallon container of each type and color of finish coat and stain used shall be delivered to the location at the project site designated by the Engineer. Containers shall be tightly sealed and labeled with color, texture, and room locations where used, in addition to the manufacturer's standard product label.

PART 2 - PRODUCTS

Products for each coating system shall be from a single manufacturer and shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI). Each product shall be shown on the MPI Approved Products List unless otherwise specified in these special provisions.

PART 3 - EXECUTION

INSPECTION

Coatings shall not be applied until surface preparation has been approved by the Engineer. The Contractor shall notify the Engineer at least 3 working days prior to the application of coatings.

SURFACE PREPARATION

Surfaces scheduled to be coated shall be prepared in conformance with the coating manufacturer's printed instructions unless otherwise specified in these special provisions.

Hardware, cover plates, light fixture trim, and similar items shall be removed prior to preparing surfaces for coating. Following the application of the finish coating, the removed items shall be reinstalled in their original locations.

Wood:

Coatings for exterior applications shall have the surface lightly sanded no more than 24 hours prior to the coating application.

A sealer recommended by the coating manufacturer shall be spot applied to knots, sap, pitch, tar, creosote, and other bleeding substances.

After the application of the prime coat, all nail holes, cracks, open joints, dents, scars, and surface irregularities shall be filled, hand cleaned, and spot primed to provide smooth surfaces for the application of finish coats.

Irregularities in wood surfaces to receive a transparent stain finish shall be filled and hand cleaned after the first coat of stain has been applied. The color of the filler shall match the color of the stained wood.

Irregularities in wood surfaces to receive a clear finish shall be filled and hand cleaned before the application of coatings. The color of the filler shall match the color of the coated wood.

Galvanized Metal:

New surfaces shall be roughened by hand sanding or light abrasive blasting. Galvanizing shall not be removed during cleaning or roughening.

Damaged or corroded areas shall be cleaned and given 2 spot applications of a coating that conforms to the requirements in the Detailed Performance Standards of the MPI, and listed on MPI List "Number 18, Primer, Zinc Rich, Organic."

Steel and Other Ferrous Metals: Surface shall be cleaned in conformance with the requirements in SSPC-SP 1. Surface profile shall be as required for the coating system specified.

Aluminum and Other Non-ferrous Metals: Surface shall be cleaned in conformance with the requirements in SSPC-SP 1.

Gypsum Board: Holes, cracks, and other surface imperfections shall be filled with joint compound or suitable filler prior to application of coatings. Taped joints and filled areas shall be hand sanded to remove excess joint compound and filler.

Concrete and Concrete Masonry Unit: New material shall be cleaned and prepared in conformance with the requirements in SSPC-SP 13. Cracks and voids shall be filled with cement mortar patching material. Concrete shall be cured until the surface moisture is below the level specified in the coating manufacturer's printed instructions.

Previously Coated Surfaces:

Dirt, oil, grease, or other surface contaminants shall be removed by water blasting, steam cleaning, or TSP wash. Minor surface imperfections shall be filled as required for new work. Mildew shall be removed by mildew wash. Chalking paint shall be removed by hand cleaning. The surfaces of existing hard or glossy coatings shall be abraded to dull the finish by hand cleaning or light abrasive blasting. Abrasive blasting shall not be used on wood or non-ferrous metal surfaces.

Chipped, peeling, blistered, or loose coatings shall be removed by hand cleaning, water blasting, or abrasive blasting. Bare areas shall be pretreated and primed as required for new work.

APPLICATION

Coatings shall be applied in conformance with the printed instructions and at the application rates recommended by the manufacturer to achieve the dry film thickness stated in the coating technical data sheet.

Mixing, thinning and tinting shall conform to the manufacturer's printed instructions. After thinning, the coating shall conform to the regulatory requirements in these special provisions.

Coatings shall be applied only when surfaces are dry and properly prepared.

Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

Materials required to be coated shall have coatings applied to all exposed surfaces, including the tops and bottoms of wood and metal doors, the insides of cabinets, and other surfaces not normally visible from eye level.

Surface Finish Application:

Each coat shall be applied to a uniform finish. Finished surfaces shall be free of surface deviations and imperfections such as skips, cloudiness, spotting, holidays, laps, brush marks, runs, sags, curtains, ropiness, improper cutting in, overspray, drips, ridges, waves, and variations in color and texture.

Each application of a multiple application finish system shall closely resemble the final color coat, except each application shall provide enough contrast in shade to distinguish the separate applications.

Work Required Between Applications:

Each application of material shall be cured in conformance with the coating manufacturer's printed instructions before applying the succeeding coating.

Enamels and clear finishes shall be lightly sanded, dusted, and wiped clean between applications.

Stain blocking primer shall be spot applied whenever bleeding substances are visible through the previous application of a coating.

Timing of Applications: The first application of the coating system shall be during the same work shift that the final surface preparation was performed. Additional coats shall be applied as soon as the required drying time of the preceding coat, specified in the coating manufacturer's printed instructions, has been met.

Application Methods:

Coatings shall be applied by brush, roller or spray. Rollers shall be of a type which do not leave a stippled texture in the paint film. Extension handles for rollers shall not be greater than 6 feet in length.

If spray methods are used, surface deviations and imperfections such as overspray, thickness deviations, lap marks, and orange peel shall be considered as evidence the work is unsatisfactory and the Contractor shall apply the remainder of the coating by brush or roller, as approved by the Engineer.

Back Priming:

The first application of the coating system shall be applied to all wood surfaces (face, back, edges, and ends) of wood materials that are not factory coated, immediately upon delivery to the project site. Surfaces of interior finish woodwork that adjoin concrete or masonry shall be coated with one application of exterior wood primer before installation.

Patches in Previously Coated Surfaces: Where patches are made on surfaces of previously coated walls or ceilings, the entire surface to corners on every side of the patch shall be coated with a minimum of one application of the finish coat.

Finishing Mechanical and Electrical Components:

Shop primed mechanical and electrical components shall be finish coated in conformance with the coating system specified for the substrate material. Louvers, grilles, covers, and access panels on mechanical and electrical components shall be removed and coated separately.

Interior surfaces of air ducts which are visible through grilles or louvers shall be coated with one application of flat black enamel, to limit of the sight line.

Exposed conduit, piping, and other mechanical and electrical components shall be painted.

Both sides and all surfaces, including edges and back of wood mounting panels for electrical and telephone equipment shall be finish coated before installing equipment.

CLEANING

Upon completion of all operations, the coated surfaces shall be thoroughly cleaned of dust, dirt, grease, or other unsightly materials or substances.

Surfaces marred or damaged as a result of the Contractor's operations shall be repaired, at his expense, to match the condition of the surfaces prior to the beginning of the Contractor's operations.

COATING SYSTEM

The surfaces to be coated shall be as shown on the plans and as specified in these special provisions. When a coating system is not shown or specified for a surface to be finish coated, the coating system to be used shall be as specified for the substrate material. The number of applications specified for each coating system listed herein is a minimum. Additional coats shall be applied if necessary to obtain a uniform color, texture, appearance, or required dry film thickness.

SYSTEM 1- ALUMINUM AND OTHER NON-FERROUS METALS:

2 Finish Coats:

Flat: Latex, exterior, MPI Gloss Level 1, MPI List Number 10
Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161
Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163
Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

SYSTEM 2- CONCRETE:

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

SYSTEM 3- CONCRETE MASONRY UNIT:

One Prime Coat:

Block Filler: Latex, Interior/Exterior MPI List Number 4

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11

SYSTEM 4- GALVANIZED METAL:

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161
Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163
Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

SYSTEM 5- GYPSUM BOARD:

One Prime Coat:

Primer Sealer: Latex, Interior, MPI List Number 50

2 Finish Coats:

Flat: Latex, Interior, MPI Gloss Level 1, MPI List Number 53
Velvet-like: Latex, Interior, MPI Gloss Level 2, MPI List Number 44
Semi-Gloss: Latex, Interior, MPI Gloss Level 5, MPI List Number 54
Gloss: Latex, Interior, MPI Gloss Level 6, MPI List Number 114

SYSTEM 6- STEEL AND OTHER FERROUS METALS, INTERIOR EXPOSURE

One Prime Coat:

Coating meeting the requirements of SSPC-Paint 15

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161
Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163
Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

SYSTEM 7- STEEL AND OTHER FERROUS METALS, EXTERIOR EXPOSURE

2 Prime Coats:

Primer: Rust Inhibitive, Water Based, MPI List Number 107

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Eggshell-like: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 3, MPI List Number 161
Semi-Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 5, MPI List Number 163
Gloss: Light Industrial coating, Water Based, Exterior, MPI Gloss Level 6, MPI List Number 164

SYSTEM 8 - WOOD, PAINTED:

1 Prime Coat:

Primer: Latex for Exterior Wood, MPI List Number 6

2 Finish Coats:

Flat: Latex, Exterior, MPI Gloss Level 1, MPI List Number 10
Low Sheen: Latex, Exterior, MPI Gloss Level 3/4, MPI List Number 15
Semi-Gloss: Latex, Exterior, MPI Gloss Level 5, MPI List Number 11
Gloss: Latex, Exterior, MPI Gloss Level 6, MPI List Number 119

COLOR SCHEDULE

Colors shall be as shown on the plans.

12-9.07 FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing fiberglass reinforced plastic (FRP) panels and trim molding in accordance with details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data, installation instructions, and finish options shall be submitted for approval.

Product descriptive data shall show the manufacturer's name and shall indicate conformance to these special provisions.

Installation instructions shall show the FRP panel manufacturer's recommended method of installation.

Finish options shall show the manufacturer's standard color palette for FRP panels and trim molding. Color shall be as shown on the plans..

PART 2 - PRODUCTS

FRP Panel: FRP panel shall be Class I flame-spread, minimum nominal thickness of 0.090 inch; Marlite, Class A/I FRP; Kemlite, Fire-X Glasbord; or equal.

Decorative FRP Panel shall be both Class A and F fire rating approvals per ASTM E-84, decorative type with rigid colored PVC base and translucent flexible PVC, Optimax HPL by CRANE Kemlite or approved equal.

Trim Molding: Trim molding shall be manufacturer's standard vinyl molding with nailing flanges and a 3/8-inch deep channel of sufficient width to receive panels and sealant.

Adhesive and Sealant: Adhesive and sealant shall be as recommended by the FRP panel manufacturer. Adhesive and sealant for decorative panel shall be color matched acrylic latex caulk with silicone.

PART 3 - EXECUTION

INSTALLATION

The FRP panels and trim molding shall be installed in accordance with the manufacturer's installation instructions.

Trim molding shall be nailed through the flange into solid wood backing. All nails shall be concealed by FRP panels in the completed installation. Trim shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard trim length. If more than one piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 4 feet in length. All FRP panel edges shall be covered by a trim molding.

Panels shall be one continuous piece along each wall unless the wall length exceeds the manufacturer's standard panel length. If more than one panel piece is used on one wall, the pieces shall be approximately equal length, with no piece less than 4 feet in length.

CLEAN-UP

Adjacent surfaces shall be protected from adhesive or sealant. Excess adhesive and sealant shall be removed as the installation progresses using a solvent or cleaning agent recommended by the FRP panel manufacturer.

12-9.08 SUSPENDED CEILINGS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing suspended ceilings in accordance with the details shown on the plans and these special provisions.

SYSTEM DESCRIPTION

Suspended ceilings shall consist of lay-in acoustical ceilings panels and an exposed grid suspension system. Listed fire rated assemblies shall be installed where shown on the plans.

Design Requirements:

The suspension system shall be designed to support the weight of ceiling panels, lighting fixtures, air terminals, service assemblies and such other items, not mentioned, which are supported by the suspended ceiling system.

The deflection of any component of the suspension system shall not exceed 1/360 of the span.

The suspension system shall be designed for seismic restraint in accordance with ASTM Designation: E 580.

Lighting fixture attachments shall be designed for a capacity of 100 percent of the lighting fixture weight acting in any direction.

SUBMITTALS

Manufacturer's descriptive data and installation instructions and complete working drawings of all supporting details, lighting fixture attachments, lateral force bracing, partition bracing and runner and panel layouts shall be submitted for approval.

PART 2 - PRODUCTS

Acoustical Panels: Acoustical panels shall be factory produced, lay-in panels, .24" x 48" x 3/4" thick, with SL edges, heavily textured cast panel. Panels shall conform to ASTM E 1264 Type III, form 4. Noise Reduction Coefficient (NRC) shall be minimum 0.65. Panels shall have a flame spread rating not exceeding 25.

Products: "Frost Clima Plus"by USG or similar and equal product by Armstrong or Celotex.

Suspension System: Suspension system shall be galvanized steel, tee shaped main runners and cross runners and wall molding angles or channels conforming to ASTM Designation: C 635, intermediate duty or heavy duty. Runners shall have exposed flanges approximately one inch wide and positive interlocks between main runners and cross runners. Wall moldings shall have a ¾-inch wide exposed face. Runners and moldings shall be bonderized and shall have a flat off-white color, factory painted finish unless otherwise shown on the plans.
Products: "Prelude" by Armstrong;"200 Snap-Grid" by Chicago Metalic: "DX Grid" by Donn Div of USG or equal.

Wire Hangers: Wire hangers shall be 12-gage minimum, galvanized, soft-annealed, mild steel wire.

Assembly Devices, Splices, Intersection Connectors and Expansion Devices: Assembly devices, splices, intersection connectors and expansion devices shall be as recommended by the suspension system manufacturer.

PART 3 - EXECUTION

INSTALLATION

The suspended ceiling shall be installed square, level and true in accordance with the approved working drawings, the manufacturer's installation instructions and the requirements of ASTM Designations: C 636 and E 580 and UBC Standard No. 25-2.

Hangers for the suspension system shall be spaced at not more than 48 inches on centers and shall be saddle tied or wrapped around the main runner members.

Except as specified herein, all lighting fixtures, air terminals, services or other ceiling supported items shall be positively attached to the suspension system.

Lighting fixtures, air terminals, services or other items weighing less than 56 pounds shall have, in addition to the requirements specified herein, two 12-gage hangers connected from the housing of the fixture, terminal, service or other items to the structure above. These hanger wires may be slack.

Lighting fixtures, air terminals, services or other items weighing more than 56 pounds shall be supported directly from the structure above.

The ceiling shall be leveled to within 1/8 inch in 12 feet.

MAINTENANCE STOCK

Upon completion of the suspended ceiling work, one unopened carton of acoustical panels shall be delivered to a location at the project site designated by the Engineer.

12-9.09 SUSPENDED GYPSUM BOARD CEILINGS

PART 1 GENERAL

SUMMARY

Scope: This work includes non-load-bearing steel framing members for interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

Related Sections: Framing exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists shall conform to the requirements specified under "Cold-Formed Metal Framing" in section 12-5 “Metals” of the Special Provisions.

SUBMITTALS

Product Data: Submit manufacturer’s product data for each type of product indicated.

PART 2 PRODUCTS

SUSPENSION SYSTEM COMPONENTS

Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

Depth: 2 inches .

Furring Channels (Furring Members):
Cold-Rolled Channels: 0.0538-inchbare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

Minimum Base Metal Thickness: 0.0312 inch.
Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

Configuration: Asymmetrical or hat shaped.

AUXILIARY MATERIALS

General: Provide auxiliary materials that comply with referenced installation standards.

Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

Isolation Strip at Exterior Walls: Provide one of the following:

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.

PART 3 EXECUTION

EXAMINATION

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.

PREPARATION

Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the work and that hangers will develop their full strength.

Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

INSTALLATION, GENERAL

Installation Standard: ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw- Attached Gypsum Panel Products," except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 "Standard Specification for Application and Finishing of Gypsum Board" that apply to framing installation.

Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, or similar construction.

Install bracing at terminations in assemblies.
Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

INSTALLING SUSPENSION SYSTEMS

Install suspension system components in sizes and spacings indicated on the plans, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

Suspend 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 suspension system.

    a. 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 locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    1. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

    Do not attach hangers to steel roof deck.

4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

Seismic Bracing: Sway-brace suspension systems with hangers used for support Installation Tolerances:
Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

SECTION 12-10. SPECIALITIES

12-10.01 TACKBOARDS

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing tackboards in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Five copies of manufacturer's descriptive data, color and texture samples and installation instructions shall be submitted for approval. Five 12’ x 12” assembled samples with selected frame and tack board. Color and texture will be selected by the Engineer after the award of the contract.

PART 2 - PRODUCTS

Tackboards: Tackboards shall be textured plastic coating on cotton-fabric, pressure laminated to ¼-inch thick cork underlayment. Cork underlayment shall be bonded to a ¼-inch thick hardboard backing. Tackboard dimensions shall be as shown on the plans.

Border Moldings: Border moldings shall be factory applied, extruded clear anodized aluminum trim.

PART 3 - EXECUTION

INSTALLATION

Tackboards shall be installed rigidly, securely, plumb and true, and in accordance with the manufacturer's recommendations.

12-10.02 MARKER BOARDS

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a marker boards in accordance with the details shown on the plans and these special provisions.

One felt eraser and 12 felt tipped liquid chalk markers of assorted colors shall be furnished for each marker board installed.

SUBMITTALS

Five copies of manufacturer's descriptive data and installation instructions shall be submitted for approval. Five 12” x 12” assembled samples with selected frame and marker board.

PART 2 - PRODUCTS

Marker Board:

Marker board shall conform to Porcelain Enamel Institute Standard PEI-S-104, and shall be porcelain enamel surface on 0.024-inch thick (24-gage) sheet steel pressure laminated to ¼-inch thick tempered hardboard. Hardboard shall have a backing of 0.015-inch nominal thickness aluminum sheet. Enamel surface shall be suitable for marking with felt tipped liquid chalk markers and erasing with a felt eraser or dry cloth. The enamel surface shall be white in color.

Marker board dimensions shall be as shown on the plans.

Trim and marker tray: Trim and marker tray shall be factory installed, satin finish, clear anodized aluminum extrusions.

PART 3 - EXECUTION

INSTALLATION

Marker boards shall be installed rigidly, securely, plumb and true in accordance with the manufacturer's instructions.

12-10.03 METAL TOILET PARTITIONS

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing metal toilet partitions in accordance with the details shown on the plans and these special provisions.

Metal toilet partitions shall consist of panels, doors, pilasters, headrails,urinal screens, fasteners, anchorages and hardware. Internal reinforcement shall be provided at all fasteners, anchorages, hardware and accessories.

Doors, panels, pilasters, and urinal screens shall be stainless steel with a No. 4 satin finish.

SUBMITTALS

Manufacturer's descriptive data, installation instructions and working drawings shall be submitted for approval.

Working drawings shall show the plan layout, door and panel elevations and all details required for the complete installation and anchorage of the partition system.

PART 2 - PRODUCTS

Doors and Panels:

Doors and panels shall be flush, one inch thick, formed of two 0.030-inch (22-gage) Type 304 stainless steel sheets over a honeycomb core. Doors and panels shall have formed edges sealed with a continuous oval crown locking strip, and shall be mitered, welded, and finished at corners.

Doors shall have controlled action hinges, with vertical pintle and ball bearing roller operating on adjustable cams, or moving parts of nylon and stainless steel. Top pivots shall be recessed into edges of doors.

Doors shall be provided with slide bar latch and a combination coat-hat hook and door stop, except as otherwise specified.

Doors on stalls designed for use by the disabled shall be provided with a grip and turn latch, combination coat-hat hook and door stop, and U-shaped door pulls immediately below the latch on the inside and outside of the door.

Pilasters: Pilasters shall be 1¼ inches thick, of the same construction as the doors and panels, except face sheets shall be 0.036-inch (20-gage), with adjustable leveling base.

Pilasters: Pilasters shall be 1¼ inches thick, of the same construction as the doors and panels, except face sheets shall be 0.052 inch for galvanized steel and 0.048 inch for stainless steel (18-gage), with adjustable, leveling base incorporating two 3/8-inch diameter stud expansion anchors with leveling nuts.

Headrails: Headrails shall be anodized aluminum, 1" x 1½" minimum, with exposed ends capped. Mount headrails to provide 80 inch clearance at stall doors.

Urinal Screens: Urinal screens shall be wedge type, wall-mounted, and of the same construction as the doors and panels, except face sheets shall be 0.040-inch (20-gage) minimum thickness. All fasteners shall be concealed.

Fasteners and Anchorages: Fasteners and anchorages shall be stainless steel with vandal resistant heads.

Hardware: Hardware shall be highly polished chromium plated, cast alloy, or heavy duty anodized aluminum.

Pilasters Anchors: Pilasters anchors shall be integral stud anchor type or internally threaded expansion sleeve type with single cone expander. Self-drilling type anchorage shall not be used.

Pilaster Shoes: Pilaster shoes shall be one-piece, stainless steel, with concealed hold down clips, and of sufficient height to completely cover the base and anchors.

PART 3 - EXECUTION

INSTALLATION

Metal toilet partitions shall be installed rigidly, securely, plumb, and true and in accordance with the manufacturer's recommendations. Tops and bottoms of doors shall align with tops and bottoms of panels, and all horizontal lines shall be level.

Rigid backing shall be provided in walls to receive anchorages.

Panels shall be anchored with at least 3 brackets at each wall and pilaster. Two anchors shall be used to fasten each pilaster base to the floor.

Doors shall not bind during opening and closing. The clearance between the door edges and pilasters shall be uniform, equidistant, and shall not exceed 3/16 inch. Hinges shall be adjusted to hold doors ajar when unlatched. Doors on stalls designed for use by the disabled shall return to the closed position.

Drilling, cutting and fitting of wall and floor finishes shall be concealed by the completed installation.

CLEAN-UP

Toilet partitions shall be cleaned, polished and free of all defects. Chipped, dented, scratched, or otherwise damaged work shall be replaced at the Contractor's expense.

12-10.04 WIRE MESH PARTITIONS

PART 1 – GENERAL

SUMMARY

Scope: This work consists of the requirements for wire mesh partitions for industrial use.

SYSTEM DESCRIPTION

Wire mesh partitions shall be all wire type, for normal industrial use, and shall be provided complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, hardware, and accessory items necessary for a complete, useable, and rigid installation.

SUBMITTALS

Working Drawings: Submit detailed Drawings of the wire mesh partitions and ceiling, including installation details, door, hardware, and accessories.

Product Data: Submit manufacturer's product data and specifications of the specified wire mesh partitions.

Samples: Submit a 12-inch by 12-inch wire mesh panel constructed of specified frame members and wire mesh.

DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle materials so as to prevent damage. Replace damaged or defective materials with new.

PART 2 – PRODUCTS

MATERIALS

Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.

Cold-Formed Steel: AISI SG-973.

Wire Mesh: Carbon steel wire, woven square mesh, intermediate crimped.

WIRE MESH PARTITIONS AND CEILING

Wire Mesh: Crimped, 10 gage steel wire woven into a 1-1/2-inch square-pattern mesh or diamond-pattern mesh, as indicated.

Frame Members: 1-1/2-inch by 3/4-inch cold-rolled steel channels with 3/16-inch bolt holes approximately 18 inches on center. Corner posts shall be structural steel.

Horizontal Reinforcing Members: 1-1/2-inch by 3/4-inch by 1/8-inch cold-rolled steel channel with wire woven through, or two 1-inch by 1/2-inch channels bolted or riveted toe-to-toe through mesh, and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer for the proposed usage.

Stiffening Bars: Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Size as recommended by partition manufacturer for partition height required. Increase size of stiffening bars, if required, to maintain partition rigidity.

Top Capping Bars: 3-inch by 4.1-pound structural steel channel secured to top framing channel with 1/4-inch "U" bolts spaced not more than 28 inches on center.

Floor Shoes: Cast metal, sized to suit vertical framing and to provide approximately 4 inches clear space between finished floor and bottom horizontal frame members. Furnish units with set screw for leveling adjustment.

DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

DOORS

Provide hinged door or sliding door, as indicated, meeting the following requirements:

Hinged Door: Door frame of 2-1/2-inch by 2-1/2-inch by 1/8-inch steel tube with 1-1/4- inch by 1/8-inch flat bar cover on top and bottom rails and on hinge stile, and 1-3/8-inch by 3/4-inch by 1/8-inch angle riveted to the lock stile.

Hinges: 2 pair of regular weight, wrought steel, non-removable pin, butt hinges riveted or welded to both door and hinge bar.

Locksets: Mortise-type cylinder lock operated by key outside with recessed knob inside.

Lock Cylinders: Cylinders for locks are specified under “Finish Hardware” in Section 12-8 “Doors and Windows’” of these special provisions.

FABRICATION

Wire shall be woven into diamond or square mesh, intermediate crimped, and securely clinched to frames. Joints shall be mortised and tendon. Wire shall be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames shall have 3/16 inch bolt holes 24 inches o.c. for normal duty partitions.

Do not provide components less than sizes indicated. Provide larger size components when recommended by partition component manufacturer for the proposed usage.

Provide anchorage devices, hardware, and installation accessories as required for a complete installation.

Finish: Provide manufacturer's standard galvanized finish for wire mesh, framing, and doors.

PART 3 - EXECUTION

INSTALLATION

Wire mesh partitions and ceiling shall be installed as indicated and in accordance with the approved Working Drawings and the manufacturer's installation instructions and recommendations.

Erect partitions plumb, rigid, true to line within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet.

Fasten and securely anchored partition system elements in place, complying with the manufacturer's recommendations for the proposed usage.

Provide additional field bracing as necessary for rigid, secure, and seismically braced installation. Provide additional clips and bracing as required.

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet.

ADJUST AND CLEAN

Adjust doors for smooth operation without binding.

Touch up damaged finish after completion of installation, using field-applied touch-up cold galvanizing compound to match color of galvanizing.

12-10.05 LOUVERS

PART 1 – GENERAL

Scope: This work consists of furnishing and installing louvers in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PART 2 - PRODUCTS

Louvers:

Louver Type: Louvers shall be heavy-duty type, manufactured of 14-gage aluminum, of size, section profile, and configuration indicated, 4 inches deep. Head, sills, and jambs to be one piece structural members of 60-63-T52 alloy. Include the furnishing of all accessories, frame, sill, anchors, and fasteners as required for a complete installation.

Fixed blade Louvers: Free area shall be 48 percent

Operable Blade Louvers: Free Area shall be 35 percent. Method of operation shall be hand operation with push bars.

Baked-Enamel Finish: All exposed aluminum surfaces shall be finished after fabrication with a satin finish, 70 percent fluoropolymer thermo-setting baked coating system which meets or exceeds the requirements of AAMA 2605. Minimum thickness shall be 1 mil. Color shall be as selected by the Engineer from manufacturer's standard color chart.

Bird Screen: Manufacturer's standard 1/2-inch mesh aluminum bird screen, mounted in removable frame and finished as specified for louvers.

Fasteners: Stainless steel, tempered aluminum, or other appropriate tempered steel treated with non-corrodible material as approved by the Engineer.

Louvers shall have integral caulking strips and retaining beads.

The finish on louvers shall be baked on primer and fluorocarbon polymeric resin.

PART 3 - EXECUTION

INSTALLATION

Louvers shall be installed in accordance with the manufacturer's instructions. The completed louver installation shall be weather tight.

12-10.06 SIGNS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing signs in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data for sign materials, colors and graphics, and for fastening hardware and material shall be submitted for approval.

PART 2 - PRODUCTS

Plastic Signs (Permanent Room Identification):

Plastic signs for permanent room identification for other than restrooms shall be scratch resistant, non-static, fire retardent, washable melamine laminate with a non-glare surface, not less than 1/8 inch thick. Letters and numbers shall be upper case Helvetica, one inch in height, 1/32 inch above and integral with sign material, accompanied by Grade 2 Braille.

Grade 2 Braille dots shall be 1/10 inch on center in each cell with 2/10-inch space between cells. Dots shall be raised a minimum of 1/40 inch above the background.

Plastic Sign (Restroom):

Plastic sign for restroom shall be not less than ¼-inch acrylic plastic. Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Male/female symbol and lettering shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Male restroom identification shall be a male symbol on an equilateral triangle with edges 12 inches long and a vertex pointing upward.

Female restroom identification shall be a female symbol on a 12-inch diameter circle.

Unisex restroom identification shall be a male and female symbol on a 12-inch equilateral triangle superimposed on a 12-inch diameter circle.

Accessible Building Entrance Sign:

Accessible building entrance sign shall be not less than 1/8-inch acrylic plastic, not less than 4" x 4" with the international symbol of accessibility.

Sign background shall be blue and shall conform to Federal Standard 595B, Color No. 15090. Symbol and border shall be white and shall conform to Federal Standard 595B, Color No. 17886.

Self-luminous Sign (Exit):

Self-luminous sign shall be internally illuminated, self-luminous exit sign powered by permanent integral tritium gas source. Sign shall be listed by the California State Fire Marshal, and UL or other approved testing laboratory.

Sign housing shall be ABS molding. Faceplate shall be acrylic.

Fastening hardware and material: Fastening hardware and material shall be as recommended by the sign manufacturer. Fasteners shall be noncorrosive.

PART 3 - EXECUTION

Inscription: Sign messages shall be as shown on the plans.

INSTALLATION

Plastic signs for room identification and restrooms shall be fastened or secured to clean, finished surfaces in accordance with the sign manufacturer's instructions. Signs shall be installed at a location and height as shown on the plans.

Fastening hardware and material shall be installed within the sign to be selected from manufacturer's standard mounting options.

12-10.07 METAL LOCKERS

PART 1 – GENERAL

SUMMARY

Scope: This work consists of providing metal lockers and wood benches for locker rooms.

SUBMITTALS

Working Drawings and Product Data: Submit fully detailed Working Drawings and manufacturer's product data of metal lockers and benches, including layout of lockers, color chips, and installation details. Include pedestal anchorage details for benches.

Samples: Submit locker manufacturer's standard color samples for selection. Submit 6 inches by 9-1/2 inches (full width) by 1-1/4 inch samples of finished bench top.

PART 2 – PRODUCTS

LOCKERS

Type and Manufacture: Lockers shall be Standard Single Tier or Double Tier and Accessible Single Tier or Double Lockers of width, depth, and height as indicated. Lockers shall be furnished with sloping tops, raised bases, fillers as needed, panel ends, anchors, fasteners, and accessories as required for a complete and finished installation. Lockers shall be manufactured to meet or exceed the following requirements:

1. Locker Units: Size and configuration as indicated.

2. Bodies: Minimum 24 gage sheet steel, formed and flanged with stiffener ribs; electrically spot welded. Bolt spacing shall not exceed 9 inches on center.

    a. Do not install mounting fasteners through the bottom of the lower locker unless it is within 1-1/2 inches of the hinge side or the back of the locker.

3. Door Frame: Minimum 16 gage sheet steel, formed channel shape, welded and ground flush, welded to locker body.

4. Doors: Minimum 18 gage sheet steel, formed channel shape at vertical edges, flanged at top and bottom, with louvers at top and bottom of door face.

5. Locker Top, Closure Panels, and Trim: Provide end panels and filler panels to close off all openings. Provide continuous sloping top. Top, panels, and trim shall be minimum 20 gage sheet steel. Finish edges smooth without burrs.

Hardware:

1. Door Handle: Door handle and latching mechanism shall be the manufacturer's accessible lever handle with integral feature for locking the door with a padlock, manufactured from a chrome-plated non-corrosive alloy.

    a. Lockers indicated as certified accessible shall be provided with door handles designed for operation without requiring tight twisting, pinching or grasping . Maximum effort to operate the handle shall not exceed 5 pounds.

2. Hinges: Provide two hinges for doors under 42 inches in height and three hinges for doors over 42 inches in height. Weld hinges securely to locker frame and rivet securely to the door.

Number Plates: Polished aluminum or stainless steel with 1/2-inch high black figures. Numbering shall be provided, beginning with the number 100 and numbered consecutively thereafter.

Accessories:

1. Standard three hooks upper and lower shelfs.
2. Accessible upper shelf 48 inches maximum above finish floor with standard pole.
3. Accessible lower shelf 15 inches minimum above finish floor.
4. Accessibility Decal: Provide international accessibility decal to indicated accessible locker doors.

Finish: Lockers, all exposed parts exterior and interior, panels, and enclosures, shall be bonderized or phosphatized to assure maximum paint adherence, primed with a corrosioninhibitive metal primer, and finished with manufacturer's baked enamel in color as selected by the Engineer from manufacturer's standards.

LOCKER BENCHES

Benches shall be manufactured from laminated maple mounted on steel tube pedestals, as follows:

1. Pedestals and Anchors: Pedestals shall consist of 1-1/2 inch nominal diameter steel tube with 10 gage steel flanges welded to each end. Welds shall be ground and dressed smooth. Provide anchorage with 1/2-inch diameter galvanized steel expansion type anchor bolts as specified under “Miscellaneous Metal” in Section 5 “Metals,” of these special provisions. Provide finish for pedestals as herein specified for lockers.

2. Bench Tops: Laminated maple, 1-1/4 inches in full finished thickness by 9-1/2 inches wide. Provide bench tops with clear penetrating lacquer or polyurethane finish, satin in texture.

3. Overall Bench Height: 18 inches nominal.

PART 3 – EXECUTION

INSTALLATION

Lockers and benches shall be installed as indicated and in accordance with the approved Working Drawings and the manufacturer's installation instructions and recommendations. Install lockers and benches in a rigid and substantial manner, straight and plumb, with all horizontal lines level.

Anchor lockers with appropriate anchor devices to suit materials encountered. Bolt adjoining locker units together to provide rigid installation. Install sloping top, end panels, and filler panels to completely close off openings.
1. Bolts in bottom of locker shall be within 2 inches of the back or hinged side walls.

Adjust and lubricate hardware for proper operation after installation. Doors shall be free from hinge bind after installation.

Clean lockers and benches on completion of work and leave free from imperfections. Protect from damage until Contract acceptance.

Lockers shall be secured to the wall to resist lateral forces from a seismic event. Fastenings shall be designed by the Contractor to resist calculated loads of full lockers.

12-10.08 FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing fire extinguishers with cabinets or mounting brackets in accordance with the details shown on the plans and these special provisions.

REFERENCES

Fire Extinguishers shall conform to the requirements in California Code of Regulations, Title 19 Division 1, Chapter 3, "Portable Fire Extinguishers."

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

QUALITY ASSURANCE

Codes and Standards: Fire extinguishers shall be Underwriters Laboratories or Factory Mutual Laboratories approved for the type, rating and classification of extinguisher specified.

PART 2 - PRODUCTS

MANUFACTURER'S

Acceptable Manufacturers: Subject to contract compliance, manufacturers shall be J. L. Industries; Larsen's Manufacturing; Potter-Roemer; or equal.

COMPONENTS

Fire Extinguisher: Fire extinguisher shall be fully charged, multi-purpose dry chemical type, with charge indicator, hose and nozzle, and attached service record tag. Fire extinguisher shall be of the capacity and type rating shown on the plans.

Fire Extinguisher Cabinet:

Fire extinguisher cabinet shall be factory fabricated, constructed of steel with a clear plastic panel in a steel door frame, and shall have a baked enamel finish. Color to be selected by the Engineer from the manufacturer's standard colors.

Fire extinguisher cabinet shall be surface mounted, semi-recessed or fully recessed as shown on the plans.

PART 3 - EXECUTION

INSTALLATION

Fire extinguishers shall be installed in locations and at mounting heights shown on the plans, or if not shown, at a height of 48 inches from the finished floor to the top of the fire extinguisher.

1. Provide U-Pulls or touch-latches for ADA compliance

Fire extinguisher mounting brackets and cabinets shall be attached to structure, square and plumb, in accordance with the manufacturer's recommendations.

IDENTIFICATION

Cabinet-mounted: Extinguishers in cabinets shall be identified with letter spelling "FIRE EXTINGUISHER" applied to the cabinet door. Letter size, styles, and color shall be selected by the Engineer from manufacturer's standard arrangements.

SERVICING

Fire extinguishers shall be serviced, charged, and tagged not more than 5 days prior to contract acceptance.

12-10.09 CANOPY AND AWNINGS

PART 1 GENERAL

SUMMARY

Scope: This work consists of the requirements to engineer, fabricate, and install aluminum canopy and awning systems complete with necessary fasteners, accessories, and trim.

SYSTEM DESCRIPTION

The canopy system consists of extruded aluminum sections (roll-formed not acceptable) that produce the architectural features indicated. System components include of one-piece rigid column and beam assemblies (structural bents), decking, fascia, accessory items and hardware. The canopy system shall be capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water underneath the canopy. Design system to drain water from deck into designated beams and out at grade level of columns through weep holes.

DESIGN REQUIREMENTS

Structural Performance: Provide aluminum canopy system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under the conditions indicated:

1. Engineer the aluminum canopy system according to procedures specified in AA ADM 105 "Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures," published by the Aluminum Association.
2. Design Loads: As required by California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 16, "Structural Design Requirements".

    a. Wind Load: 90 mph exposure "C"
    b. Snow Load: 20 psf
    c. Live Load: 30 psf
    d. Seismic: Zone IV
    e. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and service personnel.
    f. Load Combinations: Design aluminum trellis system to withstand the most critical effects of load factors and load combinations.

3. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than 1/180 of the span.

4. Thermal Movements: Provide aluminum canopy system 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 joint sealants, 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.

    a. Temperature Change (Range): 100 deg F ambient; 150 deg F material surfaces.

SUBMITTALS

Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions. Provide samples of manufacturer's standard metal finishes for selection by the Engineer.

Working Drawings: Submit detailed drawings, layout of the canopy system, bent locations (identify drain columns and wet bents), and all mechanical joint locations with complete details, connections, jointing and accessories. Include details of concrete footings and bent anchorage.

Calculations: Provide structural calculations for the proposed canopy system stamped and signed by a Civil or Structural Engineer registered in the State of California. The expiration date of the registration shall be shown.

QUALITY ASSURANCE

Qualifications:

1. Manufacturer Qualifications: The manufacturer firm shall have not less than five (5) years experienced in products or systems similar to the size and complexity indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

2. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with the requirements.

3. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.

Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

DELIVERY STORAGE AND HANDLING

Deliver aluminum canopy components and other manufactures items to the site in unopened cartons, crates, or other protective containers bearing the manufacturer's labels.

Materials delivered to the site shall be immediately unloaded in a manner to prevent bending, warping, twisting, and surface damage.

Store materials in a clean dry environment and cover with suitable weathertight and ventilated covering. Stack canopy system components in a manner to prevent contact with other materials which might cause staining, denting, or other surface damage.

PROJECT CONDITIONS

Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with aluminum canopy system by field measurements before fabrication and indicate measurements on Working Drawings.

COORDINATION

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

Coordinate installation of aluminum canopy system with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

WARRANTY

Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace aluminum components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of project completion.

PART 2 – PRODUCTS

MATERIALS

Aluminum Extrusions: 6063 alloy heat treated to a T-6 temper and not less than the strength and durability properties specified in ASTM B221 for 6063-T6.

1. Roof Deck: Extruded aluminum shapes, interlocking self-flashing sections.

2. Fascia: Manufacturer's standard extruded aluminum fascia sections as indicated and as required to complete the installation resulting in a neat finished appearance.

Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Structural Bolts: ASTM F593; alloy 304 with nuts and washers of same material.

2. Fasteners for Roof Deck: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.

3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

FABRICATION

General: Fabricate aluminum canopy components to comply with indicated profiles, dimensions and structural requirements and the approved working drawings. Fabricate sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.

Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Bents: Fabricate frame bents of shop welded one piece units. When size of bents does not permit shipment as a welded unit, fabricate with concealed mechanical joints.

Roof Deck: Shop fabricate to lengths and panels widths required for field assembly. Provide shop-induced camber in deck units as required to meet design requirements. Provide welded dams are at non-draining ends of deck.

Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. 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 (PVDF) by weight; complying with AAMA 2605.

PART 3 – EXECUTION

EXAMINATION

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

Before erection proceeds, survey elevations and locations of concrete and masonry-bearing surfaces and locations of anchor rods, base connector plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and aluminum system manufacturer's tolerances.

Proceed with erection only after unsatisfactory conditions have been corrected.

PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

ERECTION OF STRUCTURAL FRAMING

General: Erect aluminum canopy system according to AA ADM 105 ”Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures,” and manufacturer's written erection instructions and erection drawings.

1. Do not field cut, drill, or alter structural members without written approval from aluminum canopy system manufacturer's professional engineer.

2. Set structural framing accurately in locations and to elevations indicated. Maintain structural stability of structural bents during erection. Erect framing true to line, level, plumb, rigid, and secure.

3. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.

CLEANING AND PROTECTION

Damaged Units: Replace roof deck panels and other components of the work, which have been damaged or have deteriorated beyond successful minor repair.

Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by the manufacturer. Maintain in a clean condition during construction.

12-10.10 CANTILEVER STEEL SHELVING

PART 1 – GENERAL

SUMMARY

This work shall consist of furnishing and installing cantilever steel shelving in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PART 2 - PRODUCTS

Shelving: Shelving shall be factory fabricated shelves and supports capable of supporting loads of 50 pounds per square foot of shelf area. Shelves shall not deflect more than 5/16 inch when subjected to the loads specified herein and shall show no permanent deflection after removal of such loads. Shelves shall be adjustable in vertical increments of 3 inches or less. Shelving shall be of the approximate dimensions and number shown on the plans and shall have a factory applied baked enamel finish. The color shall be gray.

PART 3 - EXECUTION

Cantilever steel shelving shall be installed and fastened in accordance with the manufacturer's instructions. The completed installation shall be rigid and secure.

12-10.11 TRELLIS

PART 1 GENERAL

SUMMARY

Scope: This work consists of the requirements to engineer, fabricate, and install aluminum trellis complete with necessary fasteners and accessory items.

SYSTEM DESCRIPTION

The trellis system consists of extruded aluminum sections (roll-formed not acceptable) that produce the architectural features indicated. System components include of one-piece rigid column and beam assemblies (structural bents), decking, fascia, accessory items and hardware. The canopy system shall be capable of withstanding structural and other loads, thermally induced movement without failure.

DESIGN REQUIREMENTS

Structural Performance: Provide aluminum trellis system capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under the conditions indicated:

1. Engineer the aluminum trellis system according to procedures specified in AA ADM1 ”Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures,” published by the Aluminum Association.
2. Design Loads: As required by California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 16, “Structural Design Requirements”.

    a. Wind Load: 90 mph exposure "C"
    b. Snow Load: 20 psf
    c. Live Load: 30 psf
    d. Seismic: Zone IV
    e. Collateral Loads: Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and service personnel.
    f. Load Combinations: Design aluminum trellis system to withstand the most critical effects of load factors and load combinations.

3. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than 1/180 of the span.

4. Thermal Movements: Provide aluminum trellis systems 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 joint sealants, 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.

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

SUBMITTALS

Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions. Provide samples of manufacturer's standard metal finishes for selection by the Engineer.

Working Drawings: Submit detailed drawings, layout of trellis system, bent locations (identify drain columns and wet bents), all mechanical joint locations with complete details, connections, jointing and accessories. Include details of concrete footings and bent anchorage.

Calculations: Provide structural calculations for the proposed trellis system, stamped and signed by a civil or structural engineer registered in the State of California. The expiration date of the registration shall be shown.

QUALITY ASSURANCE

Qualifications:

1. Manufacturer Qualifications: The manufacturer firm shall have not less than five (5) years experienced in products or systems similar to the size and complexity indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

2. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.

Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

DELIVERY STORAGE AND HANDLING

Deliver aluminum trellis components and other manufactures items to the site in unopened cartons, crates, or other protective containers bearing the manufacturer's labels.

Materials delivered to the site shall be immediately unloaded in a manner to prevent bending, warping, twisting, and surface damage.

Store materials in a clean dry environment and cover with suitable weathertight and ventilated covering. Stack trellis system components in a manner to prevent contact with other materials which might cause staining, denting, or other surface damage.

PROJECT CONDITIONS

Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with aluminum trellis system by field measurements before fabrication and indicate measurements on Working Drawings.

COORDINATION

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

Coordinate installation of aluminum trellis system with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

WARRANTY

Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace aluminum components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of project completion.

PART 2 PRODUCTS

MATERIALS

Aluminum Extrusions: 6063 alloy heat treated to a T-6 temper and not less than the strength and durability properties specified in ASTM B221 for 6063-T6.

Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Structural Bolts: ASTM F593; alloy 304 with nuts and washers of same material.

2. Fasteners for Roof Deck: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.

3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

FABRICATION

General: Fabricate aluminum canopy components to comply with indicated profiles, dimensions and structural requirements and the approved working drawings. Fabricate sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.

Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Bents: Fabricate frame bents of shop welded one piece units. When size of bents does not permit shipment as a welded unit, fabricate with concealed mechanical joints.

Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. 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 (PVDF) by weight; complying with AAMA 2605.

PART 3 – EXECUTION

EXAMINATION

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

Before erection proceeds, survey elevations and locations of concrete and masonry-bearing surfaces and locations of anchor rods, base connector plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and aluminum system manufacturer's tolerances.

Proceed with erection only after unsatisfactory conditions have been corrected.

PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

ERECTION OF STRUCTURAL FRAMING

General: Erect aluminum canopy system according to AA ADM 105 "Aluminum Design Manual: Specifications and Guidelines for Aluminum Structures," and manufacturer's written erection instructions and erection drawings.

1. Do not field cut, drill, or alter structural members without written approval from aluminum canopy system manufacturer's professional engineer.

2. Set structural framing accurately in locations and to elevations indicated. Maintain structural stability of structural bents during erection. Erect framing true to line, level, plumb, rigid, and secure.

3. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.

CLEANING AND PROTECTION

Damaged Units: Replace roof deck panels and other components of the work, which have been damaged or have deteriorated beyond successful minor repair.

Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by the manufacturer. Maintain in a clean condition during construction.

12-10.12 TOILET AND SHOWER ACCESSORIES

PART 1 – GENERAL

Scope: This work shall consist of furnishing and installing toilet and shower accessories in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions and details shall be submitted for approval.

PART 2 - PRODUCTS

Toilet Tissue Seat Cover- Dispenser – Sanitary Napkin Disposal: Shall be lockable partition or flush in wall mounted type as shown on plans. dual roll per side, seat cover dispenser and sanitary napkin disposal, stainless steel with satin finish, approximately 17-3/16" x 30-5/8" x 4-5/16" deep. Sanitary napkin disposal shall be for installation in women's rest room only. Dispenser shall utilize standard toilet tissue rolls. The top roll shall automatically drop into place after the bottom roll is depleted. One dispenser per toilet stall. Shall be ADA compliant.

Combination Paper Towel Dispenser and Waste Receptacle: Combination paper towel dispenser and waste receptacle shall be semi-recessed unit of stainless steel with satin finish. The approximate size shall be 17" x 56" x 9½" deep with 4-inch skirt. The paper towel dispenser shall have a capacity of 8" wide 800 feet long rolls of paper towels. The waste receptacle shall have a capacity of not less than 12 gallons. One unit per lavatory.

Clothes Hook: Clothes hook shall be stainless steel clothes hook with 2 prongs.

Liquid Soap Dispenser: Liquid soap dispenser shall be surface mounted, heavy duty plastic dispenser for industrial use with a capacity of at least 24 ounces. One dispenser per lavatory.

Mirror, Wall Hung: Mirror, wall hung shall be Number 1 quality, ¼ inch thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Mirror, Wall Hung with Shelf: Mirror, wall hung shall be Number 1 quality, ¼ inch thick, electrolytically copper plated float or plate glass mirror with nonmoisture-absorbing filler. Mirror shall have a heavy gage galvanized steel back and stainless steel frame with integral 5-inch wide stainless steel shelf. The frame shall have a satin finish and shall be mitered and welded and the corners shall be ground smooth. Fasteners shall not penetrate surfaces of the frame exposed to view. Mirror shall conform to Federal Specification: DD-M-411b and shall be guaranteed against silver spoilage for not less than 10 years.

Steel Grab Bars: Steel grab bars shall be stainless steel, 1½-inch diameter bars and escutcheon covered integral mounting flanges.

Folding Seat (or bench): Folding seat shall be factory fabricated with teakwood or woodgrain phenolic slats, Type 304 stainless steel tube frame with satin finish, wall bracket and hinge; wood slats shall be factory stained and varnished. Size shall be as shown on the plans.

Folding Bench: Factory fabricated with almond phenolic seat bolted to 1-1/4 inch type 304 stainless steel tube frame with stainless steel folding cross members.
Operation: Seat (or bench) designed to automatically fold in a raised position against wall and fold downward and lock in sitting position with front and rear support legs.

Install using suitable steel in-wall backing and fasteners. ADA compliant mounting height.

Privacy Curtain:

Privacy curtain shall be flame resistant, one-way draw, nylon reinforced, anti-bacterial vinyl fabric. Curtain shall be 6 feet long.

Privacy curtain rod shall be stainless steel, fixed mounted shower rod with stainless steel mounting plates.

PART 3 - EXECUTION

INSTALLATION

Toilet and shower accessories shall be installed in accordance with the manufacturer's recommendations. Fasteners for mounting accessories shall be concealed and tamper proof.

Expansion anchors shall be used for mounting accessories on masonry or concrete walls.

Toilet and shower accessories shall be mounted after painting work is complete.

All toilet room accessories shall be mounted plumb, secure and rigid. Grab bars shall be supported adequately so the bars will withstand an applied load of 250 pounds at any point.

Support assembly for folding seat shall bear solidly on the wall without rocking and shall be fastened rigidly and securely to the wall in accordance with the manufacturer's recommendations.

SECTION 12-11. EQUIPMENT

12-11.01 COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing compressed air systems in accordance with the details shown on the plans and these special provisions.

The compressed air system shall include a compressor, regulators, gauges and compressed air piping.

Pipes and fittings shall be in accordance with the requirements specified under "Pipes, Fittings, and Valves," in Section 12-15, "Mechanical," of these special provisions.

Permits to Operate:

Attention is directed to the latest Division of Industrial Safety (DIS) regulations regarding tank mounted air compressors.

The Contractor shall provide all permits to operate pressure vessels in accordance with the requirements of the DIS and shall pay all costs for such permits. Such permits shall be posted under glass at the work site.

SUBMITTALS

Product Data:

Manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include a complete description, performance data and installation instructions for the materials and equipment specified herein.

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

WARRANTY

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2 - PRODUCTS

REFRIGERATED AIR DRYER

Refrigerated Air Dryer: Non-cycling hermetic type with capacity of 25 cfm capable of drying 100 psig at 100 degrees F saturated air to 35 degrees F dew point at 100 degrees F ambient, with automatic drain trap, three valve by-pass system, 1/3 hp motor and safety disconnect switch in NEMA 250 Type 1 general purpose enclosure, wired from compressor controller.

MISCELLANEOUS COMPONENTS

Air Compressor: Air compressor shall be 2-stage, 175 psig design, 125 psi output, mounted on an ASME code vertical type receiver. The air compressor shall be complete with unloader, V-belt drive, belt guard, oil and air pressure gauges, automatic pressure controller, outlet valve, ASME relief valve, air intake filter, moisture trap, ball valve drain and an automatic tank drain operated by either the compressor unloader or a governor. Motor shall be high efficiency type, open dripproof with class B insulation. Air compressor shall be Champion, Ingersol Rand, Kellogg, or equal.

Pressure Regulator:

Pressure regulator shall be combination type with filter, bowl, pressure regulator and pressure gauge.

The filter bowl shall be the quick disconnect type, plastic with metal guard, manual drain, and 5-micron filter.

Pressure regulator shall be diaphragm controlled, balanced valve type, rated for 0 to 160 psig operation and shall be equipped with pressure gage, bottom clean-out plugs and internal strainers. Regulator shall be Wilkerson, Lincoln, Wabco, or equal.

Flexible Coupling: Flexible coupling shall be brass flexible metal hose with threaded union ends and a minimum working pressure of 200 psig.

Pressure Gage: Pressure gage shall be rotary type ANSI Standard: B40.1, Grade A, with 3½-inch dial, liquid filled with cover, plain case, reset screw and bottom inlet. Pressure gage movement shall be phosphor bronze bushed. Gage shall read from 0 psi to 150 psi. Each gage shall be equipped with a gage cock. Pressure gage shall be Marsh, Ashcroft, US Gage, or equal.

PART 3 - EXECUTION

INSTALLATION

Air compressor shall be installed with drain piping, vibration isolation pads and expansion anchors.

Unions shall be installed before and after the pressure regulator/ball valve assembly.

FIELD QUALITY CONTROL

Testing:

All tests, including general performance tests to demonstrate the proper operation of the air compressor, shall be performed by the Contractor in the presence of the Engineer.

The air compressor system shall be tested for the operational range, the cut-off pressure and the operation of air drops and system components.

12-11.02 LABORATORY FUMEHOODS

PART 1 - GENERAL

SUMMARY

Scope: This work consists of the requirements for fume hoods in accordance with the details shown on the plans and these special provisions. Pipe, fittings, valves electrical components and accessories, not mentioned, shall be included that are required for the proper installation and operation of the plumbing and piping systems.

Related Sections: Casework base cabinets, counter tops, counter fittings and finishes to be integrated with fumehood assembly are specified under “Metal Laboratory Casework” in Section 12-12“Furnishings,” of these special provisions.

PERFORMANCE REQUIREMENTS

Fumehood Design: Design, calculate face velocities, and test fume hoods in accordance with ACGIH-2092S, Laboratory fume hoods, auxiliary systems, and associated equipment shall meet the requirements of NFPA 70 and NFPA 45, and CMC.

Hood Static Pressure Loss: With the sash in full-open position the static pressure loss through the fumehood shall not exceed 1/2 inch water gage when operating at 75 feet per minute (fpm), 7/8 inch water gage at 100 fpm, 1.125 inch water gage at 125 fpm.

SUBMITTALS

Product Data: For each type of product indicated. Include descriptive literature, technical data sheets, and diagrams of the accessories provided as part of the fume hood.

Working Drawings: Show fumehood assembly and the placement of all appurtenances and connection points with sizes, to utilities.

Hood Paint: Submit color chips of exterior hood paint. Submit [at least five] colors which are standard with the manufacturer.

Test Report: Submit fumehood test report showing conformance to ACGIH-2092S "Industrial Ventilation: A Manual of Recommended Practice."

Operation and Maintenance Manuals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

PART 2 - PRODUCTS

MATERIALS

Carbon Steel: ASTM A 366/A 366M, cold rolled sheets, commercial bright finish.

Stainless Steel: ASTM A 167; No 4 satin finish including welds and fabricated surfaces. Provide Type 302, 304, or 316 alloy unless otherwise specified. Provide minimum thickness of U.S. Standard 16 gage.

Safety Glass: ASTM C 1048, fully tempered "FT," clear.

Electrical Devices: Prewired at the factory to a common, integral junction box to provide easy exterior connection and disconnection.

Fumehood Assembly, Constant Volume:

Constant volume, configuration, enclosed unit mounted on base cabinet; nominal exterior dimensions to be as indicated on the plans.; interior working area at least 47 inches high.

Hood Interior, Including Working Surface: Type 304 stainless steel, with interior vertical joints and intersections of vertical surface with working surface having an approximate 20 mm 3/4 inch radius. Provide working surface with a raised rim around all sides to prevent spillage from running out face of hood.

Sash: Safety glass, 7/32 inch minimum thickness, counterbalanced, vertical sliding type, Type 304 stainless steel frame.

Baffle: Adjustable, with moving parts resistant to corrosion, removable for cleaning.

Lighting Fixtures: 8 foot fume hood only: Vapor proof, fluorescent, with cool white lamps and switch, providing 800 lux 75 foot candles on working area. Locate switch for fixture on exterior of hood frame, or in recess of base cabinet. Provide sealed safety glass window barrier between interior working and fixture spaces, and access for tube replacement exterior to hood interior working area.

Service Fixtures:

Provide remote controls for piped services and locate on hood exterior frame. Provide serrated supply ends with nozzles arranged close to sash, precluding the need of reaching to interior back of hood to make connections to outlets. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with chemical resistant coating of clear plastic over polished chrome plate.

Cold water: Remote controlled valve, with vacuum breaker; hood wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall and over cup sink.

Air: Provide fixtures for each service, each fitting with remote controlled valve and supply end (inside hood) consisting of a serrated hose nozzle and escutcheon trim. Provide air at 85 psig.

Waste: Recessed cup sink, 3 by 6 inches 3 by 9 inches, fabricated of Type 316 stainless steel, 2 liter capacity. Furnish with acid waste p-trap and locate under water faucet, integral with countertop. Provide acid vent.

Electrical convenience outlets: Two duplex, grounded, three-wire, 125 volt, 60 Hz, single phase 20 ampere. Locate in recessed area of base cabinet or on side posts of hood. Provide stainless steel or chrome-plated cover plate. Provide 20 ampere circuit breaker protection.

Blower Switch: Double-pole, 208-volt, 60-Hz, with pilot light. Locate switch in hood frame or in recess of base cabinet.

Duct Stub: Collar size suitable for ductwork indicated. Material of collar same as hood interior or metal coated with epoxy having corrosion resistance comparable to finish on fittings in hood.

PART 3 - EXECUTION

INSTALLATION

Install units at locations indicated. Conform to installation provisions of ACGIH-2092S "(2004) Industrial Ventilation: A Manual of Recommended Practice." specifically meeting the air flow requirements of fume hood(s). Provide interlocks for controls and alarms to maintain the required air balance between hood interiors and the room.

FIELD QUALITY CONTROL

Inspection: Examine each unit for visual defects, operation and conformance to specifications.

TESTS

Test each unit to ensure that the equipment is operational and conforms to specification requirements. Field tests for fume hood operation and performance shall meet the requirements of ACGIH-2092S. Provide written test report with results to the Engineer.

12-11.03 KITCHEN EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work consists of the requirements for kitchen equipment and fixtures as indicated on the drawings and in these special provisions.

SUBMITTALS

Working Drawings: Show complete layout of cabinets and electrical and plumbing services. Include elevation drawings of the unit.

Product Data: Submit description of unit kitchen components, including materials and finishes.

O&M Instructions: Submit manufacturer's operation and maintenance instructions. Operation and maintenance manuals shall be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

WARRANTY

Furnish a full one-year warranty on the entire kitchen unit, starting with the beginning at completion of contract. The warranty shall furnish to the Department, at no additional charge, parts and service on-site where the units are located to repair or replace any part of the kitchen equipment that fail because of a manufacturing defect while in use.

PART 2 - PRODUCTS

KITCHEN EQUIPMENT

General: Except as modified herein, provide manufacturer's standard materials for kitchen equipment. Provide quantities, physical dimensions, colors, and electrical characteristics as indicated.

Range Hood: UL 858, vented, with two-speed fan, permanent washable filter, top exhaust, and controls located to conform with ADA standards..

Range (free standing with oven): UL 858, four tubular plug-in surface elements of minimum 4,500 total watts at 208 volts, infinite control switches located on front face, and range indicating "on" lights. Equip oven to be self-cleaning with one minimum 2,000-watt tubular broil element and one minimum 700-watt tubular bake element, oven indicating light and automatic oven-heat control. Equip oven with black glass window door, safety door lock during self-cleaning cycle, broiler pan, self-locking oven racks, digital clock with one-hour timer, automatic oven light, oven "on" light, oven cycling light and tempered glass control panel.

Household Garbage Disposal: UL 430, continuous-feed type with hardened stainless steel grinding elements and 1/2 hp permanently lubricated motor with overload protector and manual reset. Electrical requirements: 120 V, 6.7 A, hard-wired. Provide a separate 120 V, 20 A, electrical control switch.

PART 3 - EXECUTION

INSTALLATION

Examine work areas and conditions under which the kitchen equipment is to be installed. If installation tolerances, location of electrical and mechanical connections and other conditions affecting performance are unsatisfactory installation shall not proceed until satisfactory corrections have been made.

Install kitchen equipment in accordance with approved working drawings and manufacturers' instructions.

FIELD QUALITY CONTROL

Field Inspection: Conduct inspection and testing in the presence of the Engineer. Before and after installation, inspect each piece of kitchen equipment for compliance with specified requirements.

Operation Tests: Upon completion, but before final acceptance, perform operation tests on each piece of equipment to determine that components, including controls, safety devices, and attachments, operate properly and in accordance with specified requirements.

12-11.04 LOADING DOCK EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of providing and installing loading dock equipment in accordance with the details shown on the drawings and these special provisions. Loading dock equipment shall include bumpers, hydraulic dock leveler system . The doc equipment includes the following primary components:

Dock bumpers.

Dock levelers.

Related Sections: Concrete work for recessed loading dock equipment is specified under “Cast-in-Place Concrete” in Section 12-3 “Concrete and Reinforcement,” in the Special Provisions.

DEFINITIONS

Operating Range: Maximum amount of travel above and below the loading dock level.

Working Range: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

SUBMITTALS

Product Data: Include construction details, material descriptions, rated capacities, operating characteristics, furnished specialties, accessories, dimensions of individual components and profiles, and finishes.

Working Drawings: Show fabrication and installation details. Include plans, elevations, sections, details, and attachments to other work.

Wiring Diagrams: Power, signal, and control wiring.

Samples for Initial Selection: For each type of dock seal fabric indicated.

Product Test Reports: Based on evaluation of tests performed by manufacturer and supervised and verified by a qualified independent professional engineer, indicate compliance of dock levelers with requirements of MH 30.1 for determining rated capacity, which is based on comprehensive testing within the last two years of current products.

Submittal Form: According to MH 30.1, Appendix A.

Maintenance Data: For loading dock equipment to include in maintenance manuals.

Warranties: Special warranties specified in this Section.

QUALITY ASSURANCE

Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Source Limitations: Obtain each type of loading dock equipment through one source from a single manufacturer.

Pre-installation Conference: Conduct conference at Project site.

DELIVERY, STORAGE, AND HANDLING

Store and handle dock equipment in a manner to avoid significant or permanent damage to fabric or frame.

Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

PROJECT CONDITIONS

Field Measurements: Indicate measurements on Working Drawings.

COORDINATION

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

Recessed Loading Dock Equipment: Coordinate size and location of pits to ensure proper clearances and operation of equipment.

Concrete, reinforcement, and formwork requirements are specified under "Cast-in-Place-Concrete," Section 12-3 "Concrete and Reinforcement" of these special provisions.

WARRANTY

Special Warranty for Dock Levelers: Manufacturer's standard form in which manufacturer agrees to repair or replace dock-leveler components that fail in materials or workmanship within warranty period of 10 years. Failures include, but are not limited to, the following:

Structural failures including cracked or broken structural support members and load-bearing welds.

Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.

Hydraulic system failures including failure of hydraulic seals and cylinders.

Faulty operation of operators, control system, or hardware.

PART 2 - PRODUCTS

MANUFACTURERS

Basis-of-Design Product: The design for each type of loading dock equipment is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

MATERIALS

Steel Plates, Shapes, and Bars: ASTM 36/A 36M.

Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55.

Steel Tubing: ASTM A 500, cold formed.

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.

Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWPA C2.

DOCK BUMPERS

Bumpers shall be heavy duty molded, triangular in shape, designed to provide both vertical and horizontal protection, regardless of truck bed height or angle of approach. Bumpers shall absorb 80%, or greater, of impact shock. Impact shock shall not over compress dock seals or destroy seal effectiveness. Bumpers shall be molded of rubber and reinforced with nylon, rayon, of tyrex chord. Bumpers shall be 80 durometer or higher with tensile strength of 950 to 1050 psi. Bumpers shall be UV stable. All corners shall be rounded and all bolt holes deeply recessed. Anchors shall be galvanized.

Manufacturers:

Chalfant Dock Equipment.

W.B McGuire
Or Equal

Anchorage Devices: Hot-dip galvanized steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.

RECESSED DOCK LEVELERS

General: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.

Hydraulic dock leveler shall be fully automatic. Dock leveler shall have 2-1/2 inch lip cylinder, low pressure hydraulic system, 4 inch main lift cylinder, cylinder return lines, and one horsepower motor. Dock leveler shall have lip barrier to protect against vacant dock drop off. Leveler must use biodegradable hydraulic fluid, have fully hydraulic platform positioning and lip extension, have push button activation, and have maintenance strut and lock out capability.

Rated Capacity: Capable of supporting total gross load of 40,000 pounds without permanent deflection or distortion, as determined by actual tests according to MH 30.1.

Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.

Hydraulic Operating System: Electric-powered hydraulic raising and hydraulic lowering of ramp, controlled from a remotely located push-button station. Equip leveler with a packaged unit including a unitized, totally enclosed, nonventilated electric motor, pump, manifold reservoir, and valve assembly of proper size, type, and operation for capacity of leveler indicated. Include means for lowering ramp below platform level with lip retracted behind dock bumpers. Provide a hydraulic velocity fuse connected to main hydraulic cylinder to limit loaded ramp's free fall to not more than 3 inches

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.

Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.

Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

Set curb angles in concrete edges of dock-leveler recessed pits with tops flush with loading platform. Fit exposed connections together to form hairline joints.

Clean recessed pits of debris.

INSTALLATION

General: Install loading dock equipment, as required for a complete installation.
Rough-in electrical connections according to requirements specified in Section 12-16.

Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

Welded Attachment: Plug-weld anchor holes in contact with steel inserts and fillet weld at other locations.

Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

Screw Attachment: Attach dock bumpers to wood construction with lag bolts as indicated.

Recessed Dock Levelers: Attach dock levelers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.

Attach dock levelers to loading dock platform in a manner that complies with requirements indicated for arrangement and position relative to top of platform.

Weld anchor holes in contact with continuous embedded loading dock edge channel.

Weld or bolt bumper blocks to loading dock face.

ADJUSTING AND CLEANING

Adjust loading dock equipment for proper, safe, efficient operation.

Test equipment for vertical travel within operating range indicated.

Restore marred, abraded surfaces to their original condition.

DEMONSTRATION

Engage a factory-authorized service representative to train Department's maintenance personnel to adjust, operate, and maintain loading dock equipment.

SECTION 12-12. FURNISHINGS

12-12.01 HORIZONTAL BLINDS

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing horizontal blinds in accordance with the details shown on the plans and these special provisions.

Horizontal blinds shall be standard, factory manufactured assemblies suitable for use on exterior wall windows.

SUBMITTALS

Product Data: Three sets of manufacturer's descriptive data, color chips palette of manufacturer's standard colors, and installation instructions shall be submitted for approval.

PART 2 – PRODUCTS

Horizontal Blinds:

Horizontal blinds shall be nominal one inch wide, spring tempered virgin aluminum alloy horizontal slats supported by braided polyester ladders. Braided ladders shall hold slats at equal spaces, parallel, straight, and shall provide tilt control and adequate overlap of slats. The distance between ladders shall not exceed 23 inches. Slat tilt shall be adjustable by a transparent wand. Blinds shall be adjustable to any height using lift cords.

Hardware shall be enclosed in a metal head and the opening hardware shall be clinched to the head. All metal parts shall have a corrosion resistant coating.

PART 3 - EXECUTION

INSTALLATION

Horizontal blinds shall be installed in accordance with the manufacturer's instructions.

12-12.02 METAL LABORATORY CASEWORK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of providing and installing steel laboratory casework system in accordance with the details shown on the drawings and these special provisions. The casework system includes the following primary components:

This Section includes the following:

Metal laboratory casework.
Utility-space framing at backs of base cabinets and between backs of base cabinets.
Utility-space closure panels between base cabinets and at exposed ends of utility spaces.
Laboratory countertops.
Shelves.
Metal laboratory casework system that includes support framing, filler and closure panels, wall panels, undercabinet lighting**,** and modular countertops.
Laboratory sinks and troughs.
Accessories.
Water, laboratory gas, and electrical service fittings.

Related Sections include the following:
Section 12-5 Cold Formed Metal Framing for metal- blocking for anchoring laboratory casework.
Section 12-9 - Gypsum Wallboard for reinforcements in metal-framed gypsum board partitions for anchoring laboratory casework.
Sections 12-15 "Mechanical" and 12-16 "Electrical" of these special provisions for connecting service utilities at indicated point. Piping and wiring for service fittings within laboratory casework up to point of connection are specified in this Section.

PERFORMANCE REQUIREMENTS

Structural Performance: Provide metal laboratory casework and support framing capable of withstanding the effects of the following gravity loads and stresses per support framing module without permanent deformation, excessive deflection, or binding of drawers and doors:
Top of Support Framing System: 500 lb.
Shelves: 200 lb.
Reagent Shelf: 500 lb.
Work Surface (Including Suspended Base Cabinets): 600 lb.
Suspended Base Cabinets (Each): 350 lb.
Total for Island Unit: 3400 lb.
Total for Wall Unit: 2600 lb.

Seismic Performance: Provide metal laboratory casework and support framing 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."

SUBMITTALS

Product Data: For each type of product indicated.

Working Drawings: For metal laboratory casework. Include plans, elevations, sections, details, and attachments to other work.
Indicate locations of blocking and reinforcements required for installing laboratory casework.
Indicate locations and types of service fittings, together with associated service supply connection required.
Include details of utility spaces showing supports for conduits and piping.
Include details of support framing system.
Include details of exposed conduits, if required, for service fittings.
Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
Include coordinated dimensions for laboratory equipment specified in other Sections.

Samples for Initial Selection: For factory-applied finishes, plastic-laminate countertops epoxy sinks epoxy countertops .

Samples for Verification: Unless otherwise directed, approved Sample units in an undisturbed condition at time of Substantial Completion may become part of the completed Work. Notify Engineer of their exact locations. If not incorporated into the Work, retain acceptable Sample units at Project site and remove when directed by Engineer.
6-inch- square Samples for each type of countertop material.
One full-size, finished base cabinet complete with hardware, doors, and drawers, but with countertop, and sink.
One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.

Qualification Data: For testing agency.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework finishes and countertops with requirements specified for chemical and physical resistance.

QUALITY ASSURANCE

Testing Agency Qualifications: An independent agency qualified for testing indicated, as documented according to ASTM E 548.

Source Limitations: Obtain laboratory casework, including countertops, sinks, service fittings, and accessories, through one source from a single manufacturer.
Obtain through same source from same manufacturer as fume hoods specified in Section 12-15 .
Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes, similar door and drawer configurations, and complying with the Specifications may be considered. Refer to Division 1 Section "Product Requirements."

Product Standard: Comply with SEFA 8, "Laboratory Furniture--Casework, Shelving and Tables--Recommended Practices."

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

DELIVERY, STORAGE, AND HANDLING

Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

PROJECT CONDITIONS

Environmental Limitations: Do not deliver or install metal laboratory casework until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

COORDINATION

Coordinate layout and installation of framing and reinforcements for support of metal laboratory casework.

Coordinate installation of metal laboratory casework with installation of fume hoods and other laboratory equipment.

EXTRA MATERIALS

Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.
Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

Modular Countertop Units: Two extra units of each length and material installed.

PART 2 - PRODUCTS

MANUFACTURERS

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

Metal Laboratory Casework:

BMC Industrial Educational Services, Inc.
Kewaunee Scientific Corporation; Laboratory Division.
Or Equal

Epoxy Countertops, Sinks, and Troughs:

Durcon Company, Inc. (The).
Laboratory Tops, Inc.
Prime Industries, Inc.
Or Equal

CABINET MATERIALS

Metal: Cold-rolled commercial steel sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

Minimum Metal Thickness

Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.0428 inch. Except for flammable liquid-storage cabinets, bottoms may be 0.0329 inch if reinforced.

Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.0329 inch except 0.0428 inch for back panels and doors of flammable liquid-storage cabinets and for unreinforced shelves more than 36 inches long.

Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.0528 inch.

Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.0677 inch.

Leveling and Corner Gussets: 0.0966 inch.

CABINET FABRICATION

General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Integrally frame and weld to form a dirt and vermin-resistant enclosure. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.

Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.
Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Weld drawer front to sides and bottom to form a single, integral unit. Provide drawers with rubber bumpers, ball-bearing heavy duty full extension slides, and positive stops to prevent metal-to-metal contact or accidental removal.

Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

Toe Space: Fully enclosed, 4 inches high by 3 inches deep, with no open gaps or pockets.

Table Legs: Welded tubing, not less than 2 inches square with stretchers where needed to comply with product standard. Weld or bolt leg stretchers to legs and cross-stretchers and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.
Leg Shoes: Black vinyl or rubber orSatin-finished stainless steel, open-bottom, slip-on type.

Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.

Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-2, not less than 1-5/8 inches square by 0.0966 inch thick, and connected together at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.

Base Molding: ASTM F 1861, Type TS (rubber, vulcanized thermoset), TP (rubber, thermoplastic), or TV (vinyl, thermoplastic), black, 4 inches in height. Provide on fronts and exposed sides of floor-mounted laboratory casework.

Filler Strips and Utility-Space Closure Panels: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges.

CASEWORK SYSTEM

General: Provide casework manufacturer's standard integrated system that includes support framing, suspended modular cabinets, filler and closure panels, wall panels, undercabinet task-lighting fixtures, countertops, and fittings needed to assemble system. System includes hardware and fasteners for securing support framing to permanent construction.

Cabinets can be removed and reinstalled without use of special tools for relocation within system.

Base cabinets can be removed without removing or providing temporary support for countertops.

Sinks are supported independent of base cabinets.

Support framing has provision for fastening pipe supports at utility space in not more than 1-inch increments.

System includes filler and closure panels to close spaces between support framing, cabinets, shelves, countertops, floors, and walls, unless otherwise indicated. Fabricate panels from same material and with same finish as cabinets and with hemmed or flanged edges.

Undercabinet Task-Light Fixtures: Single-tube fluorescent fixtures with switch and heavy-duty cord and plug.
Finish: Baked enamel.
Diffusers: Virgin acrylic with high resistance to yellowing and other changes due to aging, heat, and UV radiation.
Ballast Sound Rating: A.

Countertops: Provide in modular lengths indicated, without seams.

Basis-of-Design Product: The design for casework system is based on Kewaunee Advantage

METAL CABINET FINISH

Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
Colors for Metal Laboratory Casework Finish: As selected by Engineer from manufacturer's full range.

CABINET HARDWARE

General: Provide laboratory casework manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches or less in height and 3 for doors more than 48 inches in height.

Cabinet pulls: Cabinet pulls shall be 3/8 inch dia approximately 4” x 1-1/2” long approximately 3/8 inch offset, stainless steel mat finish.

Door Catches: Nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches in height.

Drawer Slides: Powder-coated, full-extension, self-closing, heavy-duty drawer slides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; complying with BHMA A156.9, Type B05091, and rated for 150 lbf.

Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide on all drawers.

COUNTERTOPS, SHELVES AND SINKS

Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.

Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Engineer.

Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.

Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.

Plastic-Laminate Countertops and Shelves:

Countertops: Plastic-laminate sheet, complying with NEMA LD 3, shop bonded with waterproof adhesive to both sides of 1-3/16-inch- thick core. Sand surfaces to which plastic laminate is to be bonded.

Plastic-Laminate Shelves: Plastic-laminate sheet complying with NEMA LD 3, shop bonded with waterproof adhesive to both sides and both edges of 3/4-inch- thick particleboard. Sand surfaces to which plastic laminate is to be bonded.

Plastic-Laminate Type for Flat Countertops:

Plastic-Laminate Type for Formed Countertops: HGP.
Plastic-Laminate Type for Shelves: HGL.
Plastic-Laminate Type for Backing: BKL.

Countertop Core: Hardwood-faced plywood, medium-density-overlaid plywood, or particleboard complying with ANSI A208.1, Grade M-2, Exterior Glue.

Colors, Textures, and Patterns: As selected by Engineer from plastic-laminate manufacturer's full range.

Construct top and backsplash from one piece of plastic laminate with rolled front and top edges and coved intersection. Provide separate end splashes of same material as top, fitted to top, where indicated. Finish exposed ends with same plastic laminate as top.

Epoxy Countertops and Sinks: Factory molded of modified epoxy-resin formulation with smooth, nonspecular finish.

Physical Properties:

Flexural Strength: Not less than 10,000 psi.
Modulus of Elasticity: Not less than 2,000,000 psi.
Hardness (Rockwell M): Not less than 100.
Water Absorption (24 Hours): Not more than 0.02 percent.
Heat Distortion Point: Not less than 260 deg F.

Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.

Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

Color: Black

Countertop Fabrication: Fabricate with factory cutouts for sinks and with butt joints assembled with epoxy adhesive and prefitted, concealed metal splines.

Countertop Configuration: Flat, with rounded edge and corners, and with drip groove and integral coved backsplash.

Shelf Configuration: Flat, with rounded edge and corners.

Stainless-Steel Countertops: Made from stainless-steel sheet, ASTM A 666, Type 304, not less than 0.0625-inch nominal thickness, with No. 4 satin finish.

Extend top down 1 inch at edges with a 1/2-inch return flange under frame. Apply heavy coating of heat-resistant, sound-deadening mastic to undersurface.

Form backsplash coved to and integral with top surface.

Reinforce underside of countertop with channels or use thicker metal sheet where necessary to insure rigidity without deflection.

Weld shop-made joints, and grind and polish surfaces to produce uniform, directionally textured finish, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

Where field-made joints are required, provide hairline butt-joints mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum.

Where stainless-steel sinks or cup sinks occur in stainless-steel countertops, factory weld into one integral unit, grind welds smooth, polish, passivate, and rinse.

Stainless-Steel Shelves: Made from stainless-steel sheet, ASTM A 666, Type 304, not less than 0.050-inch nominal thickness, with No. 4 satin finish. Weld shop-made joints, grind smooth, and finish. Fold up front edge 3/4 inch; fold up back edge 3 inches. Provide integral stiffening brackets, formed by folding up ends 3/4 inch and welding to upturned back edge.

Stainless-Steel Sinks: Made from stainless-steel sheet, ASTM A 666, Type 304, not less than 0.050-inch nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch diameter. Provide continuous butt-welded joints, grind smooth, and polish surfaces to produce nondirectional finish, free of scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

Provide factory punchings for fittings.

Provide with stainless-steel strainers and tailpieces.

Provide with integral rims except where located in stainless-steel countertops.

Apply 1/8-inch-thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

Cup Sinks: Epoxy Stainless steel, 3-by-6-inch nominal size.

Provide with stainless-steel strainers and integral tailpieces.

PART 3 - EXECUTION

EXAMINATION

Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of metal laboratory casework.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION OF CABINETS

Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

Base Cabinets: Adjust top rails and subtops within 1/16 inch of a single plane. Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

Wall Cabinets: Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c. Align similar adjoining doors to a tolerance of 1/16 inch.

Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

INSTALLATION OF COUNTERTOPS

Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Working Drawings.

Field Jointing: Where possible, make in the same manner as shop jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop.

Use concealed clamping devices for field joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

Fastening:

Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.

Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.

Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

Provide required holes and cutouts for service fittings.

Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

Carefully dress joints smooth, remove surface scratches, and clean entire surface.

INSTALLATION OF SINKS

Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant while still wet and finish joint for neat appearance.

Semiflush Installation of Stainless-Steel Sinks: Before setting, apply sink and countertop manufacturers' recommended sealant under rim lip and along top. Remove excess sealant while still wet and finish joint for neat appearance.

Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

Drop-in Installation of Epoxy and Polypropylene Cup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

Surface Installation of Epoxy and Polypropylene Cup Sinks: Set sink in sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

INSTALLATION OF ACCESSORIES

Install accessories according to Working Drawings and manufacturer's written instructions.

Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

CLEANING AND PROTECTING

Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Engineer.

Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at minimum of 48 inches o.c.

SECTION 12-13 SPECIAL CONSTRUCTION

12-13.01 SOLVENT STORAGE TANK AND SOLVENT DAY TANK

PART 1 - GENERAL

Scope: This work consists of supplying a solvent storage tank and a solvent day tank with transfer pump and motor, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

MANUFACTURER QUALIFICATIONS

Manufacturer shall have a minimum of three years experience in the design and construction of above ground storage tanks and day tank systems.

Manufactured items shall-be Underwriters Laboratories (UL) listed.

WARRANTY

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

QUALITY ASSURANCE

Codes and Standards:

U.L. 142, Underwriters Laboratories, Inc., Steel Aboveground Tanks for Flammable and Combustible Liquids.

U.L. 2085, Underwriters Laboratories 2 Hour Fire Rating's Standard for Insulated Aboveground Storage Tanks for Flammable and Combustible Liquids.

NFPA 30, National Fire Protection Association Flammable and Combustible Code.

NFPA 30A, National Fire Protection Association Automotive and Marine Service Station Code.

CFC Article 79, California Fire Code, Flammable and Combustible Liquids.

SUBMITTALS

Working Drawings:

Submit Working Drawings indicating plans, elevations, and sections; dimensions of equipment; location of fittings, and accessories with specific dimensions, electrical connections; wiring diagrams; controls; safety devices; interlocks; and mounting bases.

Design calculations, including seismic restraint, shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

Product Data: Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical requirements and wiring diagrams, and location and sizes of field connections.

Closeout Submittals: Provide Manufacturer's Installation and Maintenance Instruction including instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 2 – PRODUCTS

Solvent Storage Tank: UL 2085 listed and labeled, secondarily contained and protected, concrete-vaulted, double-walled rectangular steel. The primary tank shall be fabricated from 1/4" steel minimum thickness, air pressure tested at 3 psig and shall be constructed in accordance with UL 142. The annular space between the inner and outer walls shall be filled with a minimum of three inches of concrete. Tank capacity to be 250 gallons, two cell, split configuration with equal tank sizes of 125/125 gallon ratio. Specific split shall be confirmed with the manufacturer. Tank shall bear the U.L. 2085 label for "Insulated Secondary Containment Aboveground Tank for Flammable Liquids."

Solvent Day Tank:

Solvent Day Tank shall be constructed in accordance with Underwriters Laboratories Standard UL-142. The day tank shall also be constructed in accordance with Flammable and Combustible Liquids Code, NFPA 30; and The Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, CFC Article 79; NFPA 37. Day tank shall be made of heavy gauge steel lap joint construction. Day tank shall have capacity of 10 gallons. Tank shall include removable, welded steel top cover for indoor applications. Tank interior shall be coated with a permanent, rust inhibiting, two part epoxy. Interior temporarily coated with solvent-based or petroleum based film rust preventative shall be unacceptable. Tank shall be primed and finish painted outside. The tank shall include the following fittings:

1” NPT supply
1” NPT return
NPT fitting for emergency vent, sized as appropriate
1” NPT overflow
1” NPT alternate fuel return
1-1/4” NPT normal vent

The tank shall be provided with atmospheric (normal) vent cap with screen and appropriately sized UL Listed emergency vent cap. UL Listed emergency vent cap shall be pressure operated. Opening pressure shall be 0.5 psig; full opening pressure 2.5 psig. Limits shall be marked on top of each vent.

The solvent day tank shall include a welded steel containment basin to prevent fuel spilling into the environment in the event of a tank leakage. The basin shall consist of an open-top, welded heavy gauge steel structure sized at a minimum of 150% of the tank capacity. The basin shall be primed and finish painted.

Transfer Pump: The solvent day tank shall include a positive displacement bronze rotary gear fuel oil pump with motor to draw solvent from the solvent storage tank to the solvent day tank. Pump capacity shall be two gallons per minute minimum and provide a minimum of 15 feet of vertical lift of solvent at sea level. The motor shall be 1/3 Hp, 115 Volt-AC, TEFC and single phase.

PART 3 - EXECUTION

INSTALLATION

Install tanks and appurtenances as indicated, and in accordance with NFPA 30 and the manufacturer's installation instructions.

Pitch both tanks 1/4-inch per foot forward toward drain plug.

Locate solvent day tank outlet even with engine fuel pump centerline.

Provide earthquake restraints on both solvent tanks.

FIELD QUALITY CONTROL

Tanks and piping shall be tested in the presence of the Engineer as follows:

1. Air Test: Tank(s) and associated piping shall be pressurized with air to 5 psig for a minimum of 24 hours. The tank(s), fittings, and pipings shall have no more than a 1 psig drop over a period of 24 hours. Air gage shall be calibrated in 1/4 psig increments. Temperature shall be constant during the air test.

2. Soap Test: With tank(s) and associated piping pressurized at 5 psig, a 1 to 2 percent solution of household detergent in water shall be applied to exterior surface of tank with sponge or other acceptable means. Leaks revealed by bubbling of soap film shall be marked and, after tank is depressurized, repaired and retested until there are no leaks.

3. After testing, tank(s) and appurtenances shall be thoroughly cleaned and dried.

DEMONSTRATION AND PERSONNEL INSTRUCTION

Engage a factory-authorized service representative to train up to 8 State maintenance personnel to adjust, operate, and maintain the storage tank and day tank. Training shall last 4 hours and shall include manuals for all eight personnel.

12-13.02 CLARIFIER

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a clarifier in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

PART 2 – PRODUCTS

CONCRETE TANKS

Clarifier Tank (with Sampling Box): Clarifier tank (with sampling box) shall be a precast reinforced concrete tank of the size shown on the plans. All joints shall be at the top of the tank above the normal operating water level. The clarifier tank shall be listed and approved by either the International Association of Plumbing and Mechanical Officials (IAPMO) or the National Precast Concrete Association (NPCA), and tank shall be marked accordingly; or the design shall be stamped and certified by a California Registered Engineer as meeting the general industry standards necessary to comply with these standards.

Cones and risers shall be precast, reinforced concrete, conforming to ASTM Designation: C 478 or precast reinforced concrete pipe conforming to ASTM Designation: C 76.

MISCELLANEOUS MATERIALS

Manhole Frame and Cover: Manhole frame and cover shall be gray cast iron, conforming to ASTM Designation: A 48, Class 30 or greater (traffic type). Cover shall be T handle bar lock (no bolt), closed pick hole and shall be marked "CLARIFIER." Three T handles shall be supplied.

Cement Mortar: Cement mortar shall be one part cement to 2 to 3 parts clean plaster or concrete sand mixed with just enough water for suitable consistency.

Epoxy Adhesive: Epoxy adhesive shall be commercial quality low viscosity paste polysulfide extended epoxy formulated primarily for use in bonding new portland cement concrete to existing portland cement concrete.

Joint sealant: Plastic joint sealant shall be commercial quality butyl mastic strip type, conforming to ASTM C-900, Henry; Press-Seal; or equal.

Bituminous Coating: Bituminous coating shall be cold applied coal or epoxy based single component, self-priming, heavy duty protective coating designed for buried concrete. Bituminous coating shall be Devoc, Devtak 5A; Polykem, 938; Tnemec, 46-465; or equal.

PART 3 - EXECUTION

INSTALLATION

Clarifier tank and manhole frames and covers, traffic frames and covers, traffic frames and grates, and other appurtenances shall be installed in accordance with the manufacturer's recommendations and the approved working drawings.

Interior of tank shall be cleaned of all debris after installation of tank, barrels and manhole frame and covers is complete and prior to testing. All debris from flushing and testing shall be removed prior to use.

All joints and penetrations of septic tanks, septic tank manholes and distribution boxes shall be sealed watertight, inside and outside, with epoxy mortar or joint sealant.

The exterior surfaces of the clarifier tank and risers, except the exterior bottom of tank, shall be completely coated with 2 applications of bituminous coating, applied at a rate of 100 square feet per gallon.

12-13.03 CONTROLLED HUMIDITY ROOMS

PART 1 – GENERAL

Scope: This work consists of the requirements to design, fabricate, and install pre-fabricated controlled humidity rooms complete with modular enclosure, mechanical and electrical equipment and controls, and auxiliary components.

Related Sections:

1. Basic electrical materials shall conform to the requirements specified under "Basic Materials And Methods" in Section 12-16 “Electrical,” of these special provisions.

2. Basic plumbing materials shall conform to the requirements specified under "Pipes, Fittings and Valves" in Section 12-15 “Mechanical,” of these special provisions.

3. Basic HVAC materials shall conform to the requirements specified under "Heating, Ventilating And Air Conditioning Equipment And Systems" in Section 12-15 “Mechanical,” of these special provisions.

SYSTEM DESCRIPTION

Design Requirements:

1. General: The controlled humidity rooms shall consist of 50 percent Humidity and 100 percent Humidity rooms and shall be prefabricated, modular insulated panel construction, integrated with all essential plenums, mechanical equipment, controls, balanced air circulation and other equipment necessary to reach the environmental conditions specified.

2. Where environmental rooms are designed with common connecting walls, provide each room with independent control, airflow, and mechanical systems.

3. Maintain noise levels in special purpose room enclosures during steady state control conditions below NC-65 curve over audible frequency range as measured by standard ASA methods when external ambient is 85 decibels or less.

SUBMITTALS

Product Data: Provide manufacturer’s product data for environmental room components, control systems, and equipment indicating compliance with the contract documents. Include manufacturer's installation instructions.

Working Drawings: Provide detailed drawings indicating plans, elevations, and sections and details for all components. Include rough-in, clearance and maintenance requirements. Indicate utility requirements and connections.

Operation and Maintenance Manual: Submit complete instruction and maintenance manual for each environmental room that includes sequential operating instructions, routine preventative maintenance instructions, and complete schematic drawings of operating systems.

Warranties: Submit the manufacturer's warranty for the performance of the equipment for a two-year period following final acceptance of the work, and for a 12-month period after the equipment is put into normal and continuous operation. Furnish labor, materials and equipment to adjust the air conditioning and heating equipment during the warranty period.

QUALITY ASSURANCE

Qualifications:

1. Manufacturer's Qualifications: The manufacturer of the environmental rooms shall be regularly engaged in the design and fabrication of controlled environmental rooms for a period of not less than ten (10) years. The manufacturer shall be capable of furnishing compatible auxiliary building components and accessories shown or specified.

2. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by the environmental room system manufacturer to erect and install the manufacturer's product.

Provide products and installation conforming to NFPA 70, National and the California Electrical Code; ASHRAE 15, and the California Mechanical Code.

Test and rate the air-conditioning equipment in accordance with ARI 210/240, 310, 340, and 380 as applicable.

Equipment shall be manufactured and tested in accordance with applicable UL requirements.

Air conditioning shall be designed for and charged with non-ozone-depleting refrigerant. Hydrogenated Chlori-Flouride Carbon (HCFC) and Non Chlori-Flouride Carbon (CFC) Refrigerant.

DELIVERY STORAGE AND HANDLING

Deliver environmental room products in manufacturer's unopened marked packaging until ready for installation.

Store products in a clean weathertight location. Use methods to prevent contact with other materials that may cause staining, denting, or other surface damage.

PART 2 – PRODUCTS

MANUFACTURED UNITS

Modular Panels: Interior and exterior metal surfaces precision formed in standard width increments with insulation sandwiched between and bonded to metal surfaces.

1. Nominal Panel Thickness: 4 inch.

2. Surface Material:

a.) Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.

b.) Type 304 stainless steel.

3. Insulation: 4 inches rigid urethane; foamed-in-place; thermal conductivity (K factor) of 0.133 BTU/hr./ft squared per degrees Fahrenheit/inch; minimum R-value of 28. Underwriters Laboratories certified as having flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with ASTM E-84 and UL-723.

4. Panel Edges: Molded urethane tongue and groove construction with permanently foamed-in-place flexible PVC gasketing on interior and exterior of tongue edges. Do not use batten strips, pressure clips, or other fastening hardware for covering joints or joining panel sections.

5. Standard Finishes: Unless otherwise indicated, provide panel sections with the following surface finishes:

a. Interior Walls and Ceilings: 20 gage stainless steel with No. 2B finish.

b. Exterior Walls (exposed surfaces only): 22 gage smooth metallic-coated steel sheet with factory-applied painted finish; Color: white.

6. Closure Panels: Provide closure panels, matching materials, colors, and finishes of adjacent panel material, to fill in between building and environmental room.

Ceiling Support Assembly: Steel channel and angle supports for ceiling sections over 11'-7" in length, furnished by the modular room manufacturer.

Doors: In-fitting, flush mounted, internally reinforced. Fabricate the door and door frame of the same core thickness and construction as specified for the other panels.

1. Door Opening: 36 inches by 78 inches.

2. Gasket: Vinyl type with magnetic steel core. Provide gaskets on both sides and top of door. Provide adjustable rubber wiper gasket on bottom of door. Provide gasket with enough magnetic force to form positive airtight seal.

3. Hardware: Heavy-duty door hardware with high luster finish. Incorporate keyed lock cylinders and padlock latches into door latch and handle assemblies.

a. Hinges: Self-closing type with stainless steel pins and self-closing nylon cams. Provide three hinges.

b. Door Handle and Latch Assembly: Automatic closing type. Provide safety release mechanism on inside of room preventing personnel from being locked from outside.

4. Observation Windows in Wall Panels or Entrance Door: Manufacturer's standard observation window. The glazing shall consist of three panes of insulated glass in a frame allowing removal and replacement.

LIGHTING

Lighting Systems: Cool white fluorescent lamps, with lamps and ballasts.

1. Provide UL-approved fixtures.

2. Mount light fixtures in sufficient quantity for minimum intensities of 70 foot-candles measured 40 inches above floor.

3. Install lights to provide uniform distribution of light.

Incandescent Lights: Vapor proof lights provide for freezers operating below 32 degrees F.

Light Cycle Timer: A 24 hour on/off cycle timer shall be provided on control panel for cycling interior lighting.

SPLIT SYSTEM AIR CONDITIONING UNITS (50 PERCENT HUMIDITY ROOM)

General: Design environmental room air to be completely conditioned in ceiling plenum, with motor-driven blowers designed to recirculate air continuously to ensure temperature and humidity uniformity. Provide air handling units and remote air cooled condensing units that form a complete, fully compatible and operable system, rated in accordance with ARI 240.

Ceiling Plenum: Ceiling plenums shall be low profile and have dual horizontal air flow to evenly distribute recirculation air through the working space of the room. Air flow velocities from the registers shall not exceed 450 feet per minute.

Air Handling Units: Air handling units shall be furnished complete, including, but not limited to casing, supply fan, direct expansion coil, mixing box, filter section, and controls all factory assembled and pre-wired and shall meet following requirements:

1. Casing: Sectional Type of galvanized steel with removable galvanized steel access panels provide access to: a) both faces of evaporator coil(s), b) filters, c) mixing dampers, d) fan motor, e) Fan and f) controls. Exterior of casing shall be finished with enamel coating. Provide galvanized steel condensate pan sloped to draining drain connection and pre-piped trap.

2. Insulation: Neoprene coated, glass fiber, applied to internal surfaces with adhesive and weld pins with exposed edges of insulation coated with adhesive.

a) “K” value at 75 degrees F. Maximum 0.26 Btuh/inch/sq ft/degrees F.
b) Density: 1 inch thick, 1-1/2 lbs/cu ft.

Direct Expansion Coil: The evaporator section shall include evaporator coil, thermostatic expansion valve, and filter drier. It shall be constructed of copper tubes and aluminum fins. The coil shall be provided with a stainless steel drain pan.

Air Filter Box: The evaporator section shall be supplied with an air filter box for use with ducted installations. The filter shall be 4 inches deep, pleated type, with a minimum efficiency of 20 percent, based on ASHRAE 52-76.

Steam Generating Humidifier: The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, steam distributor, and electronic controls. The need to change canister shall be annunciated on the microprocessor wallbox control panel. The humidifier shall have a capacity of 4 lbs./hr. A light emitting diode (LED) light on the humidifier assembly shall indicate cylinder full, over-current detection, fill system fault, and end of cylinder life conditions.

SCR Electric Reheat:

a. The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include a U.L. approved safety switch to protect the system from overheating.

b. The SCR (Silicon Controlled Rectifier) controller shall proportionally control the reheat elements to maintain the selected room temperature. The rapid cycling made possible by the SCR controller provides precise temperature control, and the more constant element temperature improves heater life. The unit microprocessor control shall operate the SCR controller, while cooling is locked on. The capacity of the reheat coils shall be4.7 kW.

Condensing Units:

1. Air Cooled Condensing Units: Self-contained, packaged, factory assembled and prewired unit suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.

   a. Construction and Ratings: In accordance with ARI 210/240. Testing shall be in accordance with ASHRAE 14.

   b. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE 90A.

   c. Casing

      1) House components in galvanized steel panels with weather resistant, baked enamel finish.

      2) Mount starters, disconnects, and controls in NEMA 4 or 4X weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

      3) Provide removable access doors or panels with quick fasteners and piano hinges.

   d. Roof Curbs: Manufacturer's standard construction, or shop fabricated 18 gage minimum, 14 inch high minimum, insulated and having corrosive protective coating, complete with factory-installed wood nailer and drain nipple.

   e. The condenser coil shall be constructed of copper tubes and aluminum fins with a direct-drive propeller-type fan, and shall include a scroll compressor, high pressure switch, and lee-temp receiver. All components shall be factory assembled, charged with refrigerant, sealed, and be capable of being connected to the evaporator section using pre-charged refrigerant line sets. No internal piping, brazing, dehydration, or charging shall be required. Condensing unit shall be designed for 95 degrees F ambient and be capable of operation to –30 degrees F. A hot gas bypass circuit shall be provided to ensure operation under low load conditions.

Firestat: The firestat shall immediately shut down the system when high temperatures are detected. The firestat shall be mounted with the sensing element in the return air.

Smoke Detector: The smoke detector shall immediately shut down the environmental control system and activate the alarm system when activated. The sensing element shall be located in the return air compartment.

Remote Sensors: The unit shall be supplied with remote temperature and humidity sensors. The sensors shall be connected to the unit by a 30 ft. shielded cable.

Microprocessor Control:

1. The control system shall be microprocessor based. The wall-mounted control enclosure shall include a 2-line by 16 character liquid crystal display (LCD) display providing continuous display of operating status and alarm condition. An 8-key membrane keypad for setpoint/program control, unit on/off, and fan speed shall be located below the display.

2. Temperature and humidity sensors shall be located in the wallbox, which shall be capable of being located up to 50 feet ft from the evaporator unit, via field supplied and wired thermostat-type wire.

Monitoring:

1. The LCD display shall provide an on/off indication, fan speed indication, operating mode indication (cooling, heating, humidifying, dehumidifying) and current day, time, temperature and humidity indication. The monitoring system shall be capable of relaying unit operating parameters and alarms to the Building Control System (BCS) monitoring system.

2. Control Setpoint Parameters:

a. Temp. Setpoint 65-85 degrees F
b. Temp. Sensitivity 3 degrees F
c. Humidity Setpoint 50 percent RH
d. Humidity Sensitivity 5 percent RH

Unit Controls: The control system shall prevent compressor short-cycling by a 3 minute timer from compressor stop to the next start.

Common Alarm and Remote On/Off: A common alarm relay shall provide a contact closure to a remote alarm device. Two (2) terminals shall also be provided for remote on/off control. Individual alarms shall be “enabled” or “disabled” from reporting to the common alarm.

Temperature Calibration: The control shall include the capabilities to calibrate the temperature and humidity sensors and adjust the sensor response delay time from 1 to 90 seconds. The control shall be capable of displaying temperature values in °F or °C.

System Auto Restart: For start-up after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming shall be performed either at the unit or from the central site monitoring system.

Unit Alarm: The control system shall monitor unit operation and activate a common alarm, which provides interface user selected alarms with a remote alarm device:

High Temperature	High Water Alarm - Lockout Unit
Low Temperature	Operation
High Humidity	High Head Pressure
Low Humidity	Loss of Power
	Compressor Short Cycle

FOG ROOM SYSTEM (100 PERCENT HUMIDITY)

Description: The room must be capable of maintaining an environment of 100% humidity at 70 degrees Fahrenheit plus or minus five degrees. The room humidity level shall be maintained by a constant spray of water from ceiling mounted spray heads. The temperature of the room shall be controlled by adjusting the temperature of the spray water. A thermometer mounted in the fog room shall send a reading to the fog room control panel. The control panel mixing valve shall then mix hot and cold water to achieve the desired temperature in the room

Spray Head System: The spray head system shall consist of a continuous loop of 1/2 inch type K copper pipe with soldered fittings, and 1.5 gallon per hour spray heads spaced at 48 inch intervals. The spray head system shall be capable of maintaining an environment of 100 percent humidity at a desired temperature in the fog room during continuous operation. The spray head system shall be secured to the ceiling of the fog room using stainless steel pipe hangers and fasteners.

Control Panel: The fog room control panel shall be pre-assembled by the manufacturer, and it shall contain the components shown on the plans. The Control Panel shall be located outside of the room fog room clear of moisture, and located as shown on the plans. The Panel shall be secured using four 3/8 inch masonry expansion bolts. Hot and cold water supply lines shall be connected to the control panel using pipe unions, and as shown on the plans.

Motor Controller Temperature Sensor (MCTS): The MCTS shall be wall mounted according to the manufacturer's recommendations and located half way between the floor and ceiling of the fog room.

SOURCE QUALITY CONTROL

Manufacturer shall perform factory test and inspection on major components to assure basic quality, conformance of design, and functional operation.

1. Control Consoles: Bench test using simulator panel to test logic functions, control systems function, and alarm operations.

PART 3 - EXECUTION

EXAMINATION

Examine area where modular panels and equipment will be installed before the work of this section begins, assuring that the in place construction and surfaces are complete and capable of supporting the weight of the equipment.

Surfaces that will become inaccessible after the equipment installation shall be completed before the equipment is installed. Assure that plumbing and electrical facilities and services, that serve the equipment, have been installed, tested, and approved before installation of modular rooms and equipment.

INSTALLATION

Assemble controlled humidity room units and install mechanical equipment in accordance with manufacturer's recommendations and approved working drawings.

1. Install components straight, plumb, level and true. Install service lines at right angles to walls and floors, except where required to pitch to drains.

2. Seal or otherwise insure that fastenings to rooms do not compromise vapor barriers or insulation. Seal between piping and sleeves.

3. To the extent feasible, mount pipe, conduit, and instrumentation on the exterior and pass thru neatly drilled penetrations to the lights or other devices.

4. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

5. After completing installation, inspect exposed finishes and repair damaged finishes.

Pressurize and leak test entire system at not less than 100 psig.
Install filler panels to enclose spaces between top of walk-in room and finished ceiling and sides of unit and construction of surrounding area.

FIELD QUALITY CONTROL

Measure temperature accuracy and uniformity inside completed room using 15 thermocouple probes. Place probes throughout internal workspace at strategic locations no closer than 12 inches from surfaces.

1. Calibrate probes in 0.1 degree C water bath using National Institute of Standards & Technology (NIST) traceable thermometer.

2. Record test data on Yokogawa or Fluke Digital Data Acquisition Recorder system and turn over graphical and tablular test reports to operating personnel. Test data shall be in Excel spreadsheet format.

The Engineer may witness and confirm test results. Notify the Engineer in writing, 72 hours prior to testing.

INSTRUCTION OF DEPARTMENT'S PERSONNEL

Prior to completion of performance tests, provide manufacturer's representative to conduct demonstration for designated Department's personnel with respect to room's controls and related systems. Manufacturer's representative shall inform Department's personnel of proper room operation and maintenance. Notify the Engineer at least 72 hours in advance to permit Department's authorized representative to schedule such an instruction period.

CLEANING AND PROTECTION

Repair or remove and replace defective work, equipment, and accessories as directed upon completion of installation. Remove and refinish damaged or soiled areas. Clean exposed and semi-exposed surfaces, touch-up finish as required.

Protection: Adequately protect the work from damage until final acceptance by the Department.

SECTION 12-14 (BLANK)

SECTION 12-15 MECHANICAL

12-15.01 MECHANICAL WORK

PART 1 - GENERAL

Scope: This work shall consist of performing mechanical work in accordance with the details shown on the plans and these special provisions.

Section Includes: Mechanical work shall include furnishing all labor, materials, equipment and services required for providing heating, ventilating, air conditioning, fume and exhaust hoods, plumbing and natural gas distribution systems.

Related Work: Earthwork, foundations, sheet metal, painting, electrical, system identification, and such other work incidental and necessary to the proper installation and operation of the mechanical work shall be in accordance with the requirements specified for similar type work elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate unless specifically dimensioned on the plans. Exact routing of pipes, ducts, etc., and location of equipment is to be governed by structural conditions and obstructions. Equipment requiring maintenance and inspection is to be readily accessible.

Roof penetrations, including Controlled Humidity Rooms, shall be flashed and sealed watertight in accordance with the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS

Product Data:

A list of materials and equipment to be installed, manufacturer's descriptive data, and such other data as may be requested by the Engineer shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for plumbing fixtures, and component layout shall be included where applicable.

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals:

Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be indexed and bound in a manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material shall be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

QUALITY ASSURANCE

Codes and Standards: Mechanical work, including equipment, materials and installation, shall conform to the CBC, CMC, and to the California Code of Regulations, Title 8, Chapter 4, Division of Industrial Safety (DIS).

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION (Not applicable)

12-15.02 PIPE, FITTINGS AND VALVES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing domestic and industrial pipes, fittings and valves in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such plumbing and piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the plumbing and piping systems.

Related Work: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

All piping insulation and wrapping material shall be in accordance with the requirements specified under "Mechanical Insulation," in this Section 12-15.

Sewer and water piping 5 feet beyond buildings shall be as specified elsewhere in these special provisions.

The pipe sizes shown on the plans are nominal inside diameter. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

QUALITY ASSURANCE

Codes and Standards: Pipe, fittings and valves shall be installed in accordance with the requirements in the CPC, the manufacturer's recommendations and the requirements specified herein.

PART 2 - PRODUCTS

MATERIALS

PIPE AND FITTINGS (Class and Description)

A1: Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with 150 psig galvanized malleable iron banded screwed fittings and galvanized steel couplings. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A2: Schedule 40 galvanized steel pipe conforming to ASTM Designation: A 53, with black cast iron recessed drainage fittings. For rainwater leaders, neoprene-gasket compression couplings, Smith Blair, Dresser, or equal, may be used. The weight of the zinc coating shall be not less than 90 percent of that specified in ASTM Designation: A 53.

A3: Schedule 5 steel pipe conforming to ASTM Designation: A 135 with pressfit fittings and couplings for service as designated. Pipe and fittings shall be in accordance with National Fire Protection Association (NFPA 13-2002) Code requirements.

A4: Pipe and fittings shall be UL or FM listed, ferrous (Schedule 20 minimum) or copper (Type L minimum), suitable for the working pressure involved but not less than 175 psig. Pipe and fittings shall be in accordance with National Fire Protection Association (NFPA 13-2002) Code requirements.

B1: Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with screwed fittings suitable for working pressure involved, but not less than 175 psig. Fittings shall be listed for fire protection.

B2: Schedule 40 black steel pipe conforming to ASTM Designation: A 53, with 150 psig black malleable iron banded screwed fittings and black steel couplings.
Steel pipe coating, where required, shall be factory applied plastic. Pipe coating shall be Standard Pipe Protection, X-Tru-Coat (20-mil thickness); Pipe Line Service Corporation, Republic; 3M Company, Scotchkote 205 (12-mil thickness); or equal.

C1: Hub and plain end cast iron soil pipe with neoprene gaskets conforming to Cast Iron Soil Pipe Institute's Standard 301. Pipe, fittings and gaskets shall be of one manufacturer.

C2: Hubless cast iron soil pipe with neoprene gaskets, corrugated stainless steel shields and stainless steel clamps conforming to Cast Iron Soil Pipe Institute's Standard 301. Joint materials shall be furnished by pipe manufacturer.

D1: Ductile iron push on joint pipe conforming to AWWA Designation: C151. Fittings shall be push on ductile iron conforming to AWWA Designation: C153. Joints shall be rubber gasketed and designed for a working pressure of 350 psig. Pipe and fittings shall be supplied with bituminous outer coating and cement lining. Pipe shall be listed for fire protection.

H1: Type DWV hard copper tubing conforming to ASTM Designation: B 306, with DWV drainage fittings, stop type couplings and threaded adapters.

H2: Type K hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

H3: Type L hard copper tubing conforming to ASTM Designation: B 88, with wrought copper or cast bronze solder joint pressure fittings, stop type couplings and threaded adapters. Solder shall be lead-free.

P1: Polyethylene plastic gas pipe and fittings conforming to ASTM Designation: D 1248 and D 2513 with Standard Dimension Ratio (SDR) 11, rated for 60 psig working pressure at 73°F, socket type fittings, joined by heat fusion.

P2: Polyvinyl chloride (PVC) natural gas pipe, Class 315, conforming to ASTM Designation: D 2513. Fittings shall be Schedule 40 conforming to ASTM Designation: D 2513, and shall be primed and glued. Primer shall conform to ASTM Designation: F656. Solvent cement shall conform to ASTM Designation: D2564. Approved adapters shall be used for transition to other pipe materials.

Unions (for Steel Pipe): Unions (for steel pipe) shall be 250 psig, threaded malleable iron, ground joint, brass to iron seat, galvanized or black to match piping.

Unions (for Copper or Brass Pipe): Unions (for copper or brass pipe) shall be 150 psig cast bronze, ground joint, bronze to bronze seat with silver brazing threadless ends or 125 psig cast brass, ground joint, brass to brass seat with threaded ends.

Unions (for Brass Waste and Flush Pipes): Unions (for brass waste and flush pipes) shall be slip or flange joint unions with soft rubber or leather gaskets. Unions shall be placed on the fixture side of the traps.

Dielectric Waterway: Dielectric waterway shall be a premanufactured unit that incorporates an insulated interior lining at least 3 inches in length between the 2 pipes being connected while maintaining metal to metal contact on the exterior surface. Dielectric water way shall be listed by IAPMO (International Association of Plumbing and Mechanical Officials).

Insulating Union: Insulating union or flange as applicable shall be suitable for the service on which used. Connections shall be constructed such that the 2 pipes being connected are completely insulated from each other with no metal to metal contact. Insulating couplings shall not be used. Insulating union shall be F. H. Maloney; Central Plastics; EPCO; or equal.

Insulating Connection (to Hot Water Tanks): Insulating connection (to hot water tanks) shall be 6-inch minimum, flexible copper tubing with dielectric union at each end and designed to withstand a pressure of 150 psig and a temperature of 200°F.

VALVES

Gate Valve (2½-inch and smaller):

Gate valve (2½-inch and smaller) shall be bronze body and trim, removable bonnet and non rising stem, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 438; Nibco Scott, T-113; Jenkins, 370; or equal.

Gate valve in nonferrous water piping systems may be solder joint type with bronze body and trim. Valve shall be Kitz, 59; Nibco Scott, S-113; Jenkins, 1240; or equal.

Gate Valve (3-inch and larger, above ground): Gate valve (3-inch and larger, above ground) shall be iron body with bronze trim, removable bonnet and non-rising stem, Class 125 and same size as pipe in which installed. Gate valve shall be Crane, 461; Nibco Scott, F-619; Jenkins, 326; or equal.

Gate Valve (3-inch and larger, below ground): Gate valve (3-inch and larger, below ground) shall be AWWA double disc, hub or rubber ring type, removable bonnet and non-rising stem, equipped with operating nuts, 200 psig working pressure, and Tee handle wrench for each valve. Valve shall be Mueller, A-2380; American Valve, Model 28; or equal.

Ball Valve: Ball valve shall be two piece, minimum 400 psig WOG, bronze body and chrome plated or brass ball with full size port. Valve shall be Nibco Scott, T-580; Watts, B-6000; Kitz, 56; or equal.

Gas Valve: Gas valve shall be natural gas service type, bronze body, quarter turn, flathead and rated for 125 psig. Gas valve shall be Crane, American or equal.

Check Valve (1½-inch and smaller): Check valve (1½-inch and smaller) shall be silent spring loaded type, threaded bronze body, nylon or Teflon disc, beryllium or stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be Nibco/Scott, T-480; CPV, 36; Kitz, 26; or equal.

Check Valve (2-inch and larger): Check valve (2-inch and larger) shall be silent wafer type, full faced for installation between 125 psig flanges, iron body with bronze trim, nylon or teflon disc, stainless steel helical spring and shaft, Class 125 and same size as pipe in which installed. Check valve shall be APCO, Series 300; CPV, 10D; Metraflex, Series 900; or equal.

Pressure Reducing Valve (PRV): Pressure reducing valve (PRV) shall be direct acting, spring loaded diaphragm type control valve with balanced single seat, bronze body, bronze trim and screwed connection. PRV shall be completely self-contained and shall require no external sending pipes or outside control medium. The outlet pressure of the PRV shall be adjustable within a range of 25 psig to 70 psig.

FAUCET AND HYDRANTS

Hose Faucet: Hose faucet shall be compression type, angle pattern, wall flange at exterior locations, tee handle, ¾-inch female thread with hose end, rough chrome or nickel plated finish for locations inside building, rough brass finish for others. Hose faucet shall be supplied with an integral or nonremovable threaded outlet vacuum breaker which meets the requirements of the American Society of Sanitary Engineering (ASSE) Standard: 1011. Hose faucet shall be Nibco, No. 63VB; Chicago, No. 13T; or equal.

CLEANOUTS

Cleanout Through Wall: Cleanout through wall shall be cast iron cleanout tee type with polished stainless access plates. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, No. W-8460; Smith, No. 4532; Zurn, No. 1445; or equal.

Cleanout Through Floor:

Cleanout through floor shall have nonslip scoriated nickel bronze access plate and adjustable frame with square pattern top for ceramic tile and round pattern top for other finishes. Where floors are constructed with a membrane, access frame shall be provided with membrane clamping flange. Plug shall be countersunk brass or bronze with tapered threads. Cleanout shall be Wade, W-7000 Series; Smith, 4023 Series; Zurn, No. 1400; or equal.

Cleanout through floors in exterior locations shall be heavy duty, floating pipe type with cast iron cover. Cleanouts shall be Wade, No. W-8300-HF; Smith, No. 4253; Zurn, No. 1474; or equal.

Cleanout to Grade: Cleanout to grade shall be cast iron ferrule type. Plug shall be countersunk brass or bronze with tapered threads. Cleanout to grade shall be Wade, No. W-8450; Smith, 4420; Zurn, No 1440; or equal.

Two-Way Cleanout: Two way cleanout shall be single riser type, Tyler Pipe No. 011187; AB&I Foundry, Part No. 08446; or equal..

MISCELLANEOUS ITEMS

Water Hammer Arrestor: Water hammer arrestor shall be stainless steel body with bellows or piston. Arrestor compression chambers shall be pneumatically charged. Water hammer arrestors shall be tested and certified in accordance with the Plumbing and Drainage Institute Standard: PDI-WH201 and sized as shown on the plans.

Access Door: Access door shall be 16-gage prime coated steel, face mounting square frame, minimum 12” x 12” door with concealed hinge and screwdriver latch.

Compression Stop (Exposed): Compression stop (exposed) shall be metal full free waterway, angle type, ground joint union, non-rising stem, molded rubber seat and wheel handle.

Compression Stop (Concealed): Compression stop (concealed) shall be long neck, built-in compression stops for required wall thickness, loose key and exposed parts polished chromium plated. Supplies shall be Chicago, 1771; California Brass, No. 172; or equal.

Pressure Gages (for PRV): Pressure gages (for PRV) shall have 0 to 100 psig scale with 3½-inch minimum diameter dial. Gages shall be installed within 6 inches of the inlet and outlet sides of the pressure reducing valve. Pressure gages shall be provided with a brass gage cock.

Gas Regulator: Gas regulator shall be listed as suitable for gas and equipped with full capacity relief valve, low pressure safety shut-off and weatherproof and insect proof vent for outside installation. Capacity shall be as shown on the plans. Gas regulator shall be Fisher; Reliance; Rockwell; or equal.

Wye Strainer: Wye strainer shall be wye pattern, cast iron body and Type 304 stainless steel or monel strainer screen. The strainer screen shall have an open area equal to at least 3 times the cross sectional area of the pipe in which it is installed and shall be woven wire fabric with 20 mesh or perforated sheet with 0.032-inch maximum diameter holes.

Backflow Preventer: Backflow preventer shall be factory assembled with 2 check valves, 2 ball valves and 4 test cocks. Backflow preventers shall be of the approved double check valve devices listed by the County of Los Angeles Department of Health Services, Cross-Connection and Water Pollution Control Section, 2525 Corporate Place, Monterey Park, California 91754, Telephone (213) 881-4140.

Pipe Hanger (for piping supported from overhead): Pipe hanger (for piping supported from overhead) shall be Grinnell, Model 269; Super Struct, C711; or equal.

Pipe Wrapping Tape and Primer:

Pipe wrapping tape shall be pressure sensitive polyvinyl chloride or pressure sensitive polyethylene tape having nominal thickness of 20 mils. Wrapping tape shall be Polyken, 922; Manville, Trantex VID-20; Scotchrap, 51; or equal.

Pipe wrapping primer shall be compatible with the pipe wrapping tape used.

Floor, Wall, and Ceiling Plates: Floor, wall, and ceiling plates shall be chromium plated steel or plastic plates having screw or spring clamping devices and concealed hinges. Plates shall be sized to completely cover the hole.

Valve Box: Valve box shall be precast high density concrete with polyethylene face and cast iron traffic rated cover marked "WATER," "GAS" or "CO-SS" as applicable. Extension shall be provided as required. Valve box shall be Christy, B3; Brooks Products Company, 3TL; Frazer, 3; or equal.

Roof Drain: Roof drain shall be cast iron body, with integral flashing clamp and gravel stop with seepage openings, 15-inch nominal polyethylene low profile dome, 3-inch caulk or no-hub outlet and underdeck clamp. Roof drain shall be J. R. Smith, 1010; Zurn, Z-100; Wade, W-3500; or equal.

Floor Drain: Floor drain shall be cast iron body and flashing collar, adjustable nickel bronze 6-inch strainer head with seepage openings and caulk or no-hub outlet. Floor drain shall be round or square as shown on the plans. Floor drain shall be J. R. Smith, 2005/2010; Wade, W-1100; Zurn, Z-415; or equal.

Floor Sink: Floor sink shall be 8-inch by 8-inch, Zurn Z1910, Jay R Smith 3100 or equal.

Trench Drain:

Trench drain shall be manufactured, pre-sloped drain system, including molded fiberglass reinforced resin channels, support brackets, heavy duty steel frames and cast-iron slotted grates. Channels shall be provided in minimum 3-foot nominal modules with outlets, end caps, and connectors. Grates shall have bolted anchorage assemblies.

Trench drain modules shall have a minimum slope of 0.60 percent and minimum flow rate of 75 GPM. Trench drain shall be Advanced Building Technologies, Inc., Polydrain; Zurn, Flo Thru; or equal.

PART 3 - EXECUTION

INSTALLATION

INSTALLATION OF PIPES AND FITTINGS

Pipe and Fittings: Pipe and fittings shall be installed in accordance with the following designated uses:

Designated Use	Pipe and Fitting Class
Domestic and industrial water (CW and HW) in buildings	H3 or A1
Domestic and industrial water underground within 5 feet of the building	A1 or H2
Fire protection water riser	B1, D1 or H3
Fire protection sprinkler piping in building	A1, A3, A4 or B1
Sanitary drain piping above ground in building	H1, C1, or C2
Sanitary drain and vent piping underground within 5 feet of the building	C1 or C2
Sanitary vent piping above ground in building	A2, H1, C1, or C2
Natural gas, above ground	A1 or B2
Natural gas, underground	B2 (plastic coated), P1 or P2
Solvent piping	B2 (plastic coated underground)
Compressed air	A1
Rainwater leaders	A2
Equipment drains and relief valve discharge	H3 or A1

Installing Piping:

Water piping shall be installed generally level, free of traps and bends, and arranged to conform to the building requirements.

Piping installed underground shall be tested as specified elsewhere in these special provisions before backfilling.

Public use areas, offices, rest rooms, locker rooms, crew rooms, training rooms, storage rooms in office areas, hallway type rooms, and similar type use areas shall have concealed piping.

Storage rooms, equipment bays, labs, and loft areas shall have exposed piping.

Piping shall not be run in floor fill, except as shown on the plans.

Piping shall be installed parallel to walls. All obstructions shall be cleared, headroom preserved and openings and passageways kept clear whether shown or not. Piping shall not interfere with other work.

Where pipes pass through non fire-rated exterior walls, a clear space around pipe shall be provided. Space shall be caulked water tight with silicone caulk.

Underground copper pipe shall have brazed joints. Underground plastic pipe shall be buried with No. 14 solid bare copper wire. Wire ends at pipe ends shall be brought up 8 inches and looped around pipe.

Exposed supply and drain piping in rest rooms shall be chrome finished.

Compressed air piping shall be pitched to low point. Ball valved drips shall be provided at all low points. Branches shall be taken off top of main.

Gas piping shall not be installed under building concrete slabs or structure. An insulating connection and valve shall be installed above ground at each building supply.

Gas piping shall be pitched to equipment or to low point and provided with an 8-inch minimum dirt leg.

Plastic pipe used for natural gas shall be below grade outside of building only. Transition to Class B2 plastic coated shall be before meter, regulator, or building wall with approved metal to plastic transition fitting. PVC natural gas pipe shall be installed in accordance with International Association of Plumbing and Mechanical Officials (IAPMO) Standard: IS10.

Forty-five degree bends shall be used where offsets are required in venting. Vent pipe headers shall be sloped to eliminate any water or condensation.

Vent piping shall extend a minimum of 8 inches above the roof.

Horizontal sanitary sewer pipe inside buildings shall be installed on a uniform grade of not less than ¼ inch per foot unless shown otherwise on the plans.

Drainage pipe shall be run as straight as possible and shall have easy bends with long turns.

Wye fittings and 1/8 or 1/16 bends shall be used where possible. Long sweep bends and combination Wye and 1/8 bends may be used only for the connection of branch pipes to fixtures and on vertical runs of pipe.

Water pipe near sewers:

Water pipe shall not be installed in the same trench as sewer pipe or in parallel trenches less than 10 feet apart.

When a water pipe crosses above a sewer pipe, a vertical separation of at least 12 inches between the top of the sewer and the bottom of the water pipe shall be maintained.

Pipe Sleeves:

The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least ¾ inch larger than outside diameter of pipe. Sleeves shall be installed to provide at least 3/8-inch space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

Cutting Pipe: Pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Damaged Pipe: Pipe that is cracked, bent or otherwise damaged shall be removed from the work.

Pipe Joints and Connections:

Joints in threaded steel pipe shall be made with Teflon tape or a pipe joint compound that is nonhardening and noncorrosive, placed on the pipe and not in the fittings.

The use of thread cement or caulking on threaded joints will not be permitted. Threaded joints shall be made tight. Long screw or other packed joints will not be permitted. Any leaky joints shall be remade with new material.

Exposed polished or enameled connections to fixtures or equipment shall be made with special care, showing no tool marks or threads.

Cleaning and Closing Pipe: The interior of all pipe shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.
Securing Pipe: Pipe in the buildings shall be held in place by iron hangers, supports, pipe rests, anchors, sway braces, guides or other special hangers. Material for hangers and supports shall be compatible with the piping or neoprene isolators shall be used. Allowances shall be made for expansion and contraction. Steel pipe shall have hangers or supports every 10 feet. Copper pipe one inch or less in diameter smaller shall have hangers or supports every 6 feet and sizes larger than one inch shall have hangers or supports every 10 feet. Plastic pipe shall have hangers or supports every 3 feet. Cast iron soil pipe with neoprene gaskets shall be supported at each joint. Vertical pipes shall be supported with clamps or straps. Horizontal and vertical piping shall be securely supported and braced to prevent swaying, sagging or flexing of joints.

Hangers and Supports:

Hangers and supports shall be selected to withstand all conditions of loading to which the piping and associated equipment may be subjected and within the manufacturer's load ratings. Hangers and supports shall be spaced and distributed so as to avoid load concentrations and to minimize the loading effect on the building structure.

Hangers and supports shall be sized to fit the outside diameter of pipe or pipe insulation. Hangers shall be removable from around pipe and shall have provisions for vertical adjustment after erection. Turnbuckles may be used.

Materials for holding pipe in place shall be compatible with piping material.

Hanger rods shall be provided with locknuts at all threaded connections. Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
½” to 2”	3/8”
2½” to 3½”	1/2"
4” to 5”	5/8”
6”	3/4"

Wrapping and Coating Steel Pipe:

Steel pipe buried in the ground shall be wrapped or shall be plastic coated as specified herein:

1. Wrapped steel pipe shall be thoroughly cleaned and primed as recommended by the tape manufacturer.
2. Tapes shall be tightly applied with 1/2 uniform lap, free from wrinkles and voids with approved wrapping machines and experienced operators to provide not less than 40-mil thickness.
3. Plastic coating on steel pipe shall be factory applied. Coating imperfections and damage shall be repaired to the satisfaction of the Engineer.
4. Field joints, fittings and valves for wrapped and plastic coated steel pipe shall be covered to provide continuous protection by puttying and double wrapping with 20-mil thick tape. Wrapping at joints shall extend a minimum of 6 inches over the adjacent pipe covering. Width of tape for wrapping fittings shall not exceed 2 inches. Adequate tension shall be applied so tape will conform closely to contours of fittings. Putty tape insulation compounds approved by the Engineer shall be used to fill voids and provide a smooth even surface for the application of the tape wrap.

Wrapped or coated pipe, fittings, and filed joints shall be approved by the Engineer after assembly. Piping shall be placed on temporary blocks to allow for inspection. Deficiencies shall be repaired to the satisfaction of the Engineer before backfilling or closing in.

Thrust Blocks:

Thrust blocks shall be formed by pouring concrete between pipe and trench wall. Thrust blocks shall be sized and so placed as to take all thrusts created by maximum internal water pressure.

Plastic pipe underground shall be provided with thrust blocks and clamps at changes in direction of piping, connections or branches from mains 2 inches and larger, and all capped connections.

Union: Unions shall be installed where shown and at each threaded or soldered connection to equipment and tanks. Unions shall be located so piping can be easily disconnected for removal of equipment or tanks. Unions shall be omitted at compression stops.

Dielectric Waterway: Dielectric waterway shall be provided between metal pipes of different material, and between brass or bronze valves and steel piping.

Insulating Union and Insulating Connection:

Insulating union and insulating connection shall be provided where shown and at the following locations:

1. In metallic water, gas and air service connections into each building. Insulating connections shall be installed on the exterior of the building, above ground and after shut-off valve.
2. In water, gas and air service connections in ground at point where new metallic pipes connect to existing metallic pipes. Install valve box above insulating connection.

Bonding at Insulating Connections: Interior water piping and other interior piping that may be electrically energized and are connected with insulating connections shall be bonded in accordance with the CEC. Bonding shall all be coordinated with electrical work.

Compression Stop: Each fixture, including hose faucets, shall be equipped with a compression stop installed on water supply pipes to permit repairs without shutting off water mains. Ball valves may be installed where shown on the plans or otherwise permitted by the Engineer.

INSTALLATION OF VALVES

Pressure Reducing Valve: A capped tee connection and strainer shall be installed ahead of the pressure reducing valve.

Exterior Valves: Exterior valves located underground shall be installed in a valve box marked "Water." Extensions shall be provided as required.

INSTALLATION OF FAUCETS AND HYDRANTS

Hose Faucet and Hydrants: Faucets and hydrants shall be installed with outlets 18 inches above finished grade.

INSTALLATION OF CLEANOUTS

Cleanouts:

A concrete pad 18 inches long and 4 inches thick shall be placed across the full width of trench under cleanout Wye or 1/8 bend. Cast iron soil pipe (C1 or C2) and fittings shall be used from Wye to surface. Required clearance around cleanouts shall be maintained.

Cleanout risers outside of a building installed in a surface other than concrete shall terminate in a cleanout to grade. Cleanout to grade shall terminate in a valve box with cover marked "CO-SS". Top of box shall be set flush with finished grade. Cleanout plug shall be 4 inches below grade and shall be located in the box to provide sufficient room for rodding.

Cleanout risers installed in tile and concrete floors, including building aprons and sidewalks, shall terminate in a cleanout through floor.

INSTALLATION OF MISCELLANEOUS ITEMS

Water Hammer Arrestor: Water hammer arrestor shall be installed so that they are vertical and accessible for replacement. Water hammer arrestor shall be installed with access door when in walls or there is no access to ceiling crawl spaces. Access door location shall be where shown on the plans or as approved by the Engineer.

Gas Appliance Connection: Gas valve and flexible connector shall be provided for gas piping at each appliance. Appropriately rated gas cocks may be used in ½-inch gas pipe. Cock or valve shall be within 3 feet of the appliance.

Gas Regulator: Gas regulator shall be installed complete with dirt leg, capped test tee, union, insulating union, gas valve and fittings.

Trench Drain: Trench drain shall be installed where shown on the plans. Support brackets, leveling devices, trenching, and bedding concrete shall in accordance with the manufacturer's recommendations. Grates shall be installed flush with the finished floor, and each grate section shall be bolted to the trench drain frame.

Backflow Preventer:

Backflow preventer assembly shall include a wye strainer, backflow preventer, fittings and pipe. Assembly components shall be the same size as the pipe in which they are installed unless otherwise shown on the plans.

Chlorination:

The Contractor shall flush and chlorinate all domestic water piping and fixtures.

Calcium hypochlorite granules or tablets, if used, shall not be applied in the dry form, but shall first be dissolved into a solution before application.

The Contractor shall take adequate precautions in handling chlorine so as not to endanger workmen or damage materials. All pipes and fittings shall be completely filled with water containing a minimum of 50 ppm available chlorine. Each outlet in the system shall be opened and water run to waste until a strong chlorine test is obtained. The line shall then be closed and the chlorine solution allowed to remain in the system for a minimum of 24 hours so that the line shall contain no less than 25 ppm chlorine throughout. After the retention period, the system shall be drained, flushed and refilled with fresh water. Contractor shall dispose of chlorinated water properly.

FIELD QUALITY CONTROL

Testing:

The Contractor shall test piping at completion of roughing in, before backfilling, and at other times as directed by the Engineer.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

General Tests:

All piping shall be tested after assembly and prior to backfill, pipe wrapping, connecting fixtures, wrapping joints and covering the pipe. Systems shall show no loss in pressure or visible leaks.

The Contractor shall test systems according to the following schedule for a period of not less than 4 hours:

Test Schedule		
Piping System	Test Pressure	Test Media
Sanitary sewer and vent	10-foot head	Water
Water	125 psig	Water
Gas (except P6)	100 psig	Air
Gas (P6)	50 psig	Air
Air	125 psig	Air

During testing of water systems, valves shall be closed and pipeline filled with water. Provisions shall be made for release of air.

Sanitary sewers shall be cleared of obstructions before testing for leakage. The pipe shall be proved clear of obstructions by pulling an appropriate size inflatable plug through the pipe. The plug shall be moved slowly through the pipe with a tag line. The Contractor shall remove or repair any obstructions or irregularities.

Testing Backflow Preventers:

A certified Backflow Preventer Tester shall test Backflow preventers installed by the Contractor at the completion of the supply system installation for proper operation.

The tester shall hold a valid certificate as a Backflow Preventer Tester from the county in which the device to be tested is located or, if the county does not have a certification program for Backflow Preventer Testers, the tester shall have a certificate from one of the following:

1. The American Water Works Association.
2. A county which has a certification program for Backflow Preventer Testers. The certification under which the tester has been certified shall be acceptable to the water purveyor and the local agency having jurisdiction.

Testing for proper operation shall conform to the procedures of the county in which the testing is being performed, or, if such procedures are not available in the county, such tests shall conform to the provisions in the latest edition of the Guidance Manual For Cross Connection Control Program, which is available from the California Department of Health Services, Division of Drinking Water and Environmental Management, 601 N 7th Street, P.O. Box 942732, Sacramento, CA 94234.

12-15.03 PIPE HANGERS AND SUPPORTS

PART 1 – GENERAL

SUMMARY

Scope: This work consists of providing pipe hangers and supports for hydronic piping.

SUBMITTALS

Product Data: Provide manufacturers data for each type of pipe hanger, channel support system component, thermal pipe shields, and duct hangers, in accordance with the details shown on the plans and these special provisions.

Working Drawings: Layout of pipes and location of pipe supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details. Design calculations shall be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration shall be shown.

PART 2 - PRODUCTS

MANUFACTURERS

Available Manufacturers: Shall be subject to compliance with requirements. Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or equal:

Pipe Hangers:

B-Line Systems, Inc.
Grinnell Corp.
Michigan Hanger Co., Inc.

Channel Support Systems:

B-Line Systems, Inc.
Grinnell Corp.; Power-Strut Unit.
Unistrut Corp.

PIPE HANGERS, SUPPORTS, AND COMPONENTS

Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: Factory-fabricated components for field assembly.

Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

Thermal-Hanger Shield Inserts: 100 psig minimum compressive-strength insulation, encased in sheet metal shield.

Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

MISCELLANEOUS MATERIALS

Mechanical-Anchor Fasteners: Insert-type attachments with pullout and shear capacities appropriate for supported loads and building materials where used.

Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

Grout: ASTM C 1107, Grade B, factory-mixed and –packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout. Post hardening and volume adjusting; recommended for both interior and exterior applications. Shall be non-staining, non-corrosive, and nongaseous. Design Mix: 5000 psig, 28-day compressive strength.

PART 3 - EXECUTION

HANGER AND SUPPORT APPLICATIONS

Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types.

Adjustable Steel Clevis Hangers: For suspension of non-insulated or insulated stationary pipes, ½ inch to 12 inches.

Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps: For suspension of pipes, 3/4 inch to 12 inches, requiring clamp flexibility and up to 4 inches of insulation.

Pipe Hangers: For suspension of pipes, 1/2 inch to 4 inches, to allow off-center closure for hanger installation before pipe erection.

Clips: For support of insulated pipes not subject to expansion or contraction.

Pipe Stanchion Saddles: For support of pipes, 4 inches to 12 inches, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

Adjustable Pipe Saddle Supports: For stanchion-type support for pipes, 2 ½ inches to 3 feet if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types.

Extension Pipe or Riser Clamps: For support of pipe risers, 3/4 inch to 12 inches.

Carbon- or Alloy-Steel Riser Clamps: For support of pipe risers, 3/4 inch to 12 inches, if longer ends are required for riser clamps.

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Steel Turnbuckles: For adjustment up to 6 inches for heavy loads.

Malleable-iron Sockets: For attaching hanger rods to various types of building attachments.

Steel Weldless Eye Nuts: For 120 to 450 deg F piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types.

Top-Beam C-Clamps: For use under roof installations with bar-joist construction to attach to lower flange of structural shape.

Center-Beam Clamps: or attaching to center of bottom flange of beams.

C-Clamps: For structural shapes. Provide support strap, fastened to opposite side of beam.

Steel-Beam Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads.

Linked-Steel Clamps with Eye Nuts: For attaching to bottom of steel -Ibeams for heavy loads, with link extensions.

Malleable Beam Clamps with Extension Pieces: For attaching to structural steel.

Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads: Light 750 lbs. Medium 1500 lbs. Heavy 3000 lbs.

Side-Beam Brackets: For sides of steel or wooden beams.

Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types.

Steel Pipe-Covering Protection Saddles: To fill interior voids with insulation that matches adjoining insulation.

Protection Shields: Of length recommended by manufacturer to prevent crushing insulation.

Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high density. 100 psig minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types.

Restraint-Control Devices: Where indicated to control piping movement.

Spring Cushions: For light loads if vertical movement does not exceed 1 ¼ inches.

Spring Sway Braces: To retard sway, shock, vibration, or thermal expansion in piping systems.

Variable-Spring Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

Variable-Spring Base Supports: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. If mounted vertically, provide two vertical-type supports and one trapeze member.

HANGER AND SUPPORT INSTALLATION

Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

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.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Attach clamps and spacers to piping. Piping Operating above Ambient Air Temperature: Clamp may project through insulation. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert. Do not exceed pipe stress limits according to ASME B31.9. Install protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe 4 inches and larger if pipe is installed on rollers. Install protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees. Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe 4 inches and larger if pipe is installed on rollers.

Shield Dimensions for Pipe: Not less than the following:

3/8 inch to 3 ½ inches: 12 inches long and 18 gage.
4 inches: to 12 inches: 18 inches long and 14 gage.

Pipes 8 inch and Larger: Include wood inserts.

Insert Material: Length at least as long as protective shield.

Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

Hanger rods shall be sized as follows:

Pipe Size	Minimum Hanger Rod Diameter
½” to 2”	3/8”
2 ½” to 3 ½”	½”
4” to 5”	5/8”
6”	¾”

EQUIPMENT SUPPORTS

Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

Grouting: Place grout under supports for equipment and make smooth bearing surface.

ADJUSTING

Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

12-15.04 HOT AND CHILLED WATER PUMPS

PART 1 – GENERAL

SUMMARY

Scope: This work includes furnishing and installing water pumps for hot water heating and chilled water cooling systems.

Related Work: Testing and balancing hot water heating and chilled water cooling pumps shall be as specified in "Testing, Adjusting, and Balancing of HVAC" elsewhere in the special provisions.

SUBMITTALS

Product data: Pump submittal shall include performance curves and rated capacities; physical data; furnished specialties; final impeller dimensions; and accessories for each type of pump indicated. Indicate pump operating points on curves. Wiring Diagrams, shall detail wiring for power, signal, and control systems. Maintenance Data, for pumps shall include maintenance manuals.

Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for pumps for inclusion in operating and maintenance manuals. Include parts and special tools lists.

QUALITY ASSURANCE

Regulatory Requirements and Standards:

Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

Electrical Components, Devices, and Accessories, shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

DELIVERY, STORAGE AND HANDLING

Manufacturer's preparation for shipping shall include treatment with anticorrosion compound after assembly and testing of all exposed machined metal surfaces.

Protect flanges, and pipe openings with wooden flange covers or with screwed-in plugs.

Store pumps in dry location. Retain protective covers for flanges and protective coatings during storage. Protect bearings and couplings against damage from sand, grit, and other foreign matter. Comply with pump manufacturer's written rigging instructions.

PART 2 - PRODUCTS

General: Pump Units shall be factory assembled and tested. Motors shall include built-in, thermal-overload protection and sealed bearings. Select each motor to be non-overloading over the full range of the pump performance curve. Pump motors shall have minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

Hot Water and Chilled Water Pumps:

Hot water and chilled water pumps shall be centrifugal, single-stage, bronze-fitted, rated for 175 psig minimum working pressure and a continuous water temperature of 225 deg F. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gage tapings at inlet and outlet connections.

Impeller shall be ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

Shaft and Sleeve shall be steel shaft with oil-lubricated copper sleeve. Seals: Mechanical type. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

Pump bearings shall be sealed, bronze journal and thrust type and motor bearings shall be sealed, sleeve type.

Acceptable manufacturers include Bell & Gossett ITT; Grundfos Pumps Corporation: PACO Pumps; or equal.

PART 3 - EXECUTION

EXAMINATION

Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation. Examine foundations and inertia bases for suitable conditions where pumps are to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

PUMP INSTALLATION

Install pumps according to manufacturer's written instructions. Provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

Support pumps and piping separately so piping is not supported by pumps.

Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers or pedestal mount as indicated on the plans.

TESTING.--

Pre-start-up checks:

1. Lubricate bearings.

2. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.

3. Check suction piping connections for tightness to avoid drawing air into pumps.

4. Clean strainers.

5. Verify that pump controls are correct for required application.

12-15.05 SYSTEM IDENTIFICATION

PART 1 - GENERAL

SUMMARY

Scope: This work consists of equipment and piping identification tags, markers, and nameplates, and their respective schedules.

SUBMITTALS

Product Data: Submit manufacturers' product data for the specified products.

Working drawings: Submit valve numbering schedules,machinery numbering schedules and fan numbering schedules for each system, .

Samples: Submit color, letter style, and graphic representation required for each identification material and device.

Closeout Submittals: Valve Numbering Schedules for each piping system including extra copies (in addition to mounted copies) to include in maintenance manuals.

QUALITY ASSURANCE

ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

PART 2 - PRODUCTS

EQUIPMENT IDENTIFICATION DEVICES

Equipment Nameplates: Equipment Nameplates shall be metal, with data engraved or stamped, for permanent attachment on equipment. The nameplate shall be accessible and visible, and shall include the necessary fasteners required to mount on equipment. The information included on the nameplate shall include, but not be limited to the following: Manufacturer, product name, model number, and serial number, capacity, operating and power characteristics, and other essential data. Labels of tested compliances shall be installed.

Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

Terminology: Match schedules as closely as possible.

Equipment Marker: Data shall include, but not be limited to the following:

1. Equipment Name

2. Equipment service

3. Design capacity

Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

Fasteners: Self-tapping, stainless steel screws or contact-type, permanent adhesive.
Or type as approved by the Engineer.

Piping Identification Devices: Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

Colors: Comply with ASME A13.1, unless otherwise indicated.

Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length. For pipes with an OD including insulation of less than 6 inches provide full-band pipe markers extending 360 degrees around pipe at each location. For pipes with an OD including insulation of 6 inches and larger provide full-band or strip-type pipe markers at least three times letter height and of length required for label.

Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe marker to indicate direction of flow.

Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

Plastic Tape: Continuously printed, vinyl tape at least 0.003 inches thick with pressure sensitive, permanent-type, self-adhesive back. Width for Markers on Pipes with an OD, Including Insulation, of less than 6 inches shall be 3/4 inch minimum. Width for Markers on Pipes with an OD, Including Insulation, of 6 inches or Larger shall be 1 1/2 inches minimum.

Valve Tags: Stamped or engraved with ¼ inch letters for piping system abbreviation and ½ inch numbers, with numbering scheme approved by the Engineer. Provide 1/8 inch hole for fastener. Material thicknesses shall be as follows:

1. Brass: 0.003 inch thick.
2. Stainless Steel: 0.04 inch thick.
3. Laminated Plastic: 0.094 inch thick with 2 black surfaces and white inner layer.

Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing. Size: 3 by 5 inch minimum.

1. Fasteners: Brass grommet and wire.

2. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

3. Color: Yellow background with black lettering.

VALVE SCHEDULES

Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), and normal operating position (open, closed, or modulating). Mark valves for emergency shutoff and similar special uses.

PART 3 -EXECUTION

EQUIPMENT IDENTIFICATION

Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment: Pumps, chillers, and similar motor-driven units, fan coil unit, exhaust fans and valves.

Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

Distinguish among multiple units, indicate operational requirements, and indicate safety and emergency precautions, warn of hazards and improper operations, and identify units. Identify mechanical equipment with equipment markers in the following color codes:

1. Green - For cooling equipment and components.
2. Yellow - For heating equipment and components.
3. Green and Yellow for combination cooling and heating equipment and components.

Piping Identification: Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms.

Valve Tag Installation: Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape - 1 1/2 inches, round.

2. Valve-Tag Color - Natural .

3. Letter Color - Black.

Warning Tag Installation: Write required message on, and attach warning tags to, equipment and other items where required.

Item	Minimum Lettering Height
Nameplate date	1/4 inch
Drain signs	3/4 inch
Tamper sign	3/4 inch

12-15.06 MECHANICAL INSULATION

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing mechanical insulation in accordance with the details shown on the plans and these special provisions.

Piping insulation shall be installed on all domestic hot water piping, above grade, in non-conditioned spaces.

Piping insulation for all hydronic supply and return piping is specified elsewhere in these special provisions.

P-trap, hot water supply pipes and angle valves for lavatories and sinks, except in janitor closets or similar enclosed spaces, shall be insulated.

Duct insulation shall be installed on all rigid ductwork installed in non-conditioned spaces.

Duct liner shall be installed in all rectangular ductwork installed in exposed non-conditioned spaces and in exterior locations. Plenum liner shall be installed in all plenums in non-conditioned spaces or in walls facing a non-conditioned space.

QUALITY ASSURANCE

Codes and Standards:

Mechanical insulation shall conform to California State Energy Commission regulations and, where applicable, shall meet American Society of Testing and Materials (ASTM) standards.

All materials shall bear the label of the Underwriters Laboratory (UL) or other approved testing laboratory indicating that the materials proposed for use conform to the required fire hazard ratings.

Pipe safety insulation shall conform to Section 1504(b) of the CPC.

PART 2 - PRODUCTS

MATERIAL

General:

All pipe insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread rating of not more than 25 and smoke development rating of not more than 450 when tested in accordance with ASTM Designation: E 84.

Duct insulation and wrapping material, including adhesives and jackets, located within buildings shall be certified to have a composite flame spread of not more than 25 and smoke development rating of not more than 50 when tested in accordance with ASTM Designation: E 84.

Domestic Water Piping Insulation: Piping insulation shall be glass fiber molded pipe insulation with factory applied jacket suitable for service temperatures up to 350°F. Covering jacket shall have pressure sealing lap adhesive joints. Pipe insulation shall have a minimum thermal resistance of R-3. Insulation and jackets shall be Owens-Corning, Fiberglass 25 with ASJ/SSL All Service Jacket; Manville, Micro-Lok 650ML with AP-T All Purpose Jacket; or equal.

Piping Insulation Cement: Insulation cement shall be Fenco, All Purpose Cement; Manville, JM375; or equal.

PVC Jacket: PVC jacket shall be rated for a service temperature of 175°F. PVC jacket shall include covers specifically designed to cover pipe fittings.

Alternative Pipe Insulation: Alternative pipe insulation shall be closed cell, elastomeric material in a flexible tubular form. Insulation shall have a service temperature range between -40°F and 200°F, a minimum vapor transmission rating of 0.20 perm-inch, and a minimum thermal resistance of R-3.

Pipe Safety Insulation: Pipe safety insulation for P-traps, hot water supply pipes and angle valves shall be molded closed cell vinyl or closed cell foam with exterior vinyl surface. Pipe safety insulation shall be configured to protect against contact. Pipe safety insulation shall be Truebro Inc., Handi Lav-guard; Plumberex Specialty Products, Handy Shield; or equal.

External Duct Insulation: External duct insulation shall be 1½ inch thick, one-pound density glass-fiber blanket type. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. External duct insulation shall be Fiberglas, Type PF-336; Ultralite, No. 100; Pittsburgh Plate Glass, Superfine; Johns-Manville, Microlite; Silvercote, Silvercel; or equal.

Plenum and Duct Liner: Plenum and duct liner shall be one-inch minimum thickness. Material and coatings shall be fire resistive and shall be approved by the State Fire Marshal. Liner shall be Gustin-Bacon, Ultra-Liner duct insulation; Owens-Corning Fiberglas, Type CE; Gustin-Bacon, coated insulation Board No. 90-A; Owens-Corning Fiberglas 1½-pound density coated flexible duct liner; Johns-Manville, MicroBar, or 1½-pound density coated Microlite; Pittsburgh Plate Glass, Superfine 1½-pound density coated interior duct insulation; or equal.

Adhesive: Adhesive shall be non-flammable type: Benjamin Foster Company, No. 85-20 Spark Safe; Goodloe E. Moore Company, Tuff Bond No. 6; Permacel, No. PA-3l0; 3M, No. 38 Insulation Adhesive; Swift's, No. 7228 brush type or No. 7336 spray type; Chicago Mastic, 17-461; or equal.

Studs: Studs shall be cement-in-place type, pneumatic driven type or percussive welding type, and shall have one-inch minimum diameter washers.

Insulation Inserts: Insulation inserts at pipe hangers supports for pipes 2 inches or larger shall be calcium silicate, cellular glass, or other acceptable material of the same thickness as the adjacent insulation and not less than 13-pound density.

PART 3 - EXECUTION

INSTALLATION

Insulation materials shall be neatly installed with smooth and even surfaces, jackets drawn tight and smoothly cemented down.

Insulation material shall not be installed until all pipes or surfaces to be covered are tested for leaks, cleaned and dried, and foreign materials, such as rust, have been removed.

Piping Insulation:

Piping insulation shall be in accordance with the following, except that unions, unless integral with valves, and flexible connections shall not be insulated:

a. Where insulation butts against flanges or is discontinued, insulation shall be tapered to pipe to allow for covering jacket to completely seal off end of insulation.

b. Insulation shall be extended on the valve bodies up to the valve bonnet.

c. Extend insulation continuous through pipe hangers and pipe sleeves. At hangers where pipe is supported, provide an insulated protection shield.

d. Insulating cement shall be applied to fittings, valves, and strainers and troweled smooth to thickness of adjacent covering. Strainer cleanout plugs shall remain accessible. Covers fabricated from molded pipe covering may be used in lieu of cement, provided covers are neat and well secured.

Jacket flap shall be sealed down with factory applied self-sealing lap. Seams shall be lapped not less than 1½ inches. Jacket shall be secured with aluminum bands installed at 12-inch centers.

Exposed outdoor insulation shall have an additional 0.016-inch minimum thickness aluminum jacket applied over the completed insulation. The jacket shall have a factory applied moisture barrier and shall be Childers; Smith; or equal.

End joints shall be lapped with aluminum holding traps located directly over the lap. Additional aluminum holding straps shall be placed at 8-inch centers. Jacket at ells and tees shall be mitered, or premanufactured fitting jackets shall be provided, with additional aluminum holding bands, as required. All joints shall be sealed watertight using silicon type, heat resistant sealant.

In-ground insulation shall have an additional PVC jacket applied over the completed insulation and vapor barrier. PVC jacket shall be made watertight with adhesive or sealant as recommended by the PVC jacket manufacturer.

Alternate pipe insulationmay be installed on hot water piping in concealed areas, before connections are made or the insulation may be slit lengthwise, applied to pipe and sealed with adhesive.

Pipe Safety Insulation: Pipe safety insulation shall be installed in accordance with the manufacturer's recommendations.

Duct Insulation:

Ragged edges shall be repaired or taped. Coverings shall be neatly finished at joints and edges. Each joint shall have a 2-inch minimum lap.

Where transitions are made between externally covered ducts and lined ducts, the lined duct shall be overlapped 8 inches with external covering.

Insulation shall be flush with but not cover control devices, damper controls or access doors.

Before insulation is wrapped around concealed ducts, an adhesive shall be spot applied at a maximum of 4-inch centers on each side of the ducts to prevent sagging of the insulation. Insulation shall be wrapped entirely around the ducts and shall be wired securely in place with No. 16 copper clad wire, metal bands at least ½ inch wide or plastic ties. Supports shall be spaced a maximum of 12 inches on center. Metal bands shall be installed with the use of a banding machine. Seams in the insulation shall be taped.

The finished insulation covering shall be even and level and shall not contain humps.

Plenum and Duct Liner:

Plenums and exposed ducts shall be lined with plenum and duct liner. Plenums and ducts shall be sized to provide the clear inside dimensions shown on plans after the liner is installed.

The insulation shall be applied with coated side exposed to air stream to prevent surface erosion.

The lining shall be fastened in place with adhesive and with studs with washers spaced a maximum of 18 inches on center each way.

Applying Adhesive: The adhesive shall be liberally applied over entire interior surfaces of ducts or plenums.

Stud Installation:

Studs shall be installed as follows:

1. Cement-In-Place Type Studs: Cement-in-place type studs shall be cemented in place with adhesives manufactured for this purpose and shall be as recommended by the stud manufacturer. Cement-in-place type studs shall be used where concrete walls form part of plenum.

2. Percussive Welding Type Studs: Percussive welding type studs shall be carefully welded in place with current settings that will not appreciably burn galvanizing on opposite side of the sheet metal.

3. Pneumatic Driven Type Studs: At locations where pneumatic driven type studs are used, hardened steel backup plates or dollies shall be used under the sheet metal.

12-15.07 PIPE INSULATION

PART 1 - GENERAL

SUMMARY.--

Scope: This work includes furnishing and installing preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds on above ground, interior hydronic piping systems..

Related Work:

Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping," in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Pipe insulation shields, protection saddles and supports shall be as specified in “Hangers and Supports” elsewhere in these special provisions.

SUBMITTALS.--

Product Data: Provide manufacturers product data for each product indicating total installation instructions, support details, thermal loads, and performance curves. Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

Working Drawings: Working Drawings shall show fabrication and installation details for the following: Application of protective shields, saddles, and inserts at pipe hangers and wall penetration for all conditions proposed. Insulation application at elbows fittings, flanges, valves, and specialties for each type of insulation. Removable insulation at piping specialties and equipment connections. Application of field-applied jackets. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

QUALITY ASSURANCE.--

Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

Insulation Value: Hydronic piping insulation conductivity and thickness shall comply with Title 24 “Standards Table 123-A Pipe Insulation Thickness”.

PART 2 - PRODUCTS

INSULATION MATERIALS

Mineral-Fiber Insulation: Mineral-fiber insulation shall be glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe and Fitting Insulation shall comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retardant jacket.

2. Blanket Insulation is to be used at specality fittings and valves. Comply with ASTM C 553, Type II, without facing.

3. Fire-Resistant Adhesive shall comply with MIL-A-3316C in the following classes and grades: Class 1, Grade A for bonding glass cloth and tape to unfazed glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfazed glass-fiber insulation. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

4. Vapor-Retarder Mastics shall be Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-1 9565C, Type II. Mineral-Fiber Insulating Cements: Comply with ASTM C 195. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Adhesive and Ultraviolet-Protective Coating to be as recommended by insulation material manufacturer.

Polyolefin Insulation: Unicellular polyethylene thermal plastic, preformed pipe insulation. Comply with ASTM C 534, Type I, except for density. Adhesive to be as recommended by insulation material manufacturer.

FIELD-APPLIED JACKETS

General: Comply with ASTM C 921, Type 1, unless otherwise indicated.

PVC Jacket and Fittings Covers:

1. High-impact, ultraviolet-resistant PVC; 20 mils thick; Pre-formed or roll stock ready for shop or field cutting and forming.

2. Fitting Covers shall be pre-formed factory-fabricated fitting covers manufactured from 30-mil thick, high-impact, ultraviolet-resistant PVC. Pre-formed shapes shall include 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, mechanical joints.

3. Adhesive shall be as recommended by insulation material manufacturer.

4. PVC Jacket Color to be white or gray.

Aluminum Jacket and Fitting Covers:

1. Factory cut and rolled to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper. Jacket to have a stucco-embossed finish and be a minimum 0.016 inch thick.

2. Jacket to have a moisture barrier of 1-mil- thick, heat-bonded polyethylene and kraft paper.

3. Fitting Covers shall be preformed shapes which include 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, mechanical joints.

ACCESSORIES AND ATTACHMENTS

Glass Cloth and Tape:

1. Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 0.88-oz/sq. ft.

2. Tape Width - 4 inches

3. Bands - 3/4 inch wide, in one of the following materials compatible with jacket:

Stainless Steel: ASTM A 666, Type 304; 0.02 inches thick.
Aluminum: 16 gage thick.

4. Wire: 14 gage, nickel-copper alloy; 0.06 inch, soft-annealed, stainless steel; or 16 gage, soft-annealed, galvanized steel.

VAPOR RETARDERS AND CONDENSATION PREVENTION

All chilled water piping and equipment shall be insulated so as to prevent moisture condensation on exterior surfaces. If condensation occurs any time during the warranty period, the contractor shall re-work the insulation until satisfactory, at no additional expense to the State. Mastic materials shall be compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application. Proceed with installation only after unsatisfactory conditions have been corrected.

Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

INSULATION USE

Mineral-Fiber Insulation may be used for heating hot water piping, chilled water piping, and condensate drain piping.

Flexible Elastomeric Thermal Insulation and Polyolefin Insulation may be used for chilled water piping and condensate drain piping.

INSTALLATION REQUIREMENTS

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

All HVAC chilled water and hot water shall have a PVC or aluminum jacket. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

All open cell insulation shall have a vapor retarder film applied prior to the outer jacket being installed.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing Apply insulation with tight longitudinal seams and end joints.

Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Do not use scrap pieces of insulation where full length or cut to length pieces will work.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

For insulation application where vapor retarder are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations:

For insulation application where vapor retarder is indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Circumferential Joints: Cover with 3 inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o/c.

Longitudinal Seams: Overlap jacket seams at least 1½ inch. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o/c. Do not staple longitudinal laps on insulation having a vapor retarder.

Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic

Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

Floor Penetrations: Apply insulation continuously through floor assembly. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

MINERAL-FIBER INSULATION APPLICATION

Insulation to straight pipes and tubes: Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor retarder mastic. Apply vapor retarder to ends of insulation and at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.

For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o/c. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Insulation to fittings and elbows: Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

Insulation to valves and specialties: Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

FIELD-APPLIED JACKET APPLICATION

Apply PVC jacket where indicated, with 1 inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

Apply metal jacket where indicated, 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 O.C. and at end joints.

FINISHES

Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.

Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed work.

12-15.08 AUTOMATIC FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of designing, furnishing and installing an automatic wet pipe type fire sprinkler system, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

The automatic fire sprinkling system shall include water flow indicator, check valve, electric alarm bellvalves, sprinkler heads and related appurtenances, valves, piping and fittings.

Related Work: Where pipes pass through fire rated wall, floor or ceiling assemblies, the penetration shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Design:

The design of the sprinkler system shall be in accordance with the code requirements for ordinary hazard occupancies, group 3, and shall provide coverage of the entire building area as indicated on the plans.

The water pressure and flow rate shall be verified with the local agency having jurisdiction.

SUBMITTALS

Working Drawings: Complete working drawings, including written verification of the water pressure and flow rate, shall be submitted for approval.

State Fire Marshal Approval: Prior to the submittal of the working drawings, the Contractor shall have said drawings stamped "APPROVED" by the State Fire Marshal. Allow 12 weeks for State Fire Marshal review and approval.

QUALITY ASSURANCE

Codes and Standards: All work shall be in accordance with the requirements of the State Fire Marshal, the National Fire Protection Association (NFPA) Standard No. 13-1999, "Installation of Sprinkler Systems," and the requirements of other regulatory authorities having jurisdiction.

PART 2 - PRODUCTS

Water Flow Indicator: Water flow indicator shall be UL or FM listed for fire protection, vane type switch designed for wet pipe systems. Water flow indicator shall be designed for minimum flow rate of 10 GPM, and shall have an adjustable delay setting of from 0 to 90 seconds. Water flow indicator shall be Viking, Model VSR-D; Grinnell, Model F620; Reliable, Model A; or equal.

Check Valve: Check valve shall be UL or FM listed, swing type, self draining, iron body with brass trim and rubber clapper with removable cover plate. Check valve shall be Viking, Grinnell, Groeniger, or equal.

Alarm Bell: Alarm bell shall be UL or FM listed electric bell type, 120 volt AC with a minimum sound rating of 95 decibels at 10 feet. Alarm bell shall have a die cast aluminum housing with built-in rubber gasket for dust proof seal for bell striking mechanism. Alarm bell shall be Viking, Grinnell, Reliable, or equal.

Pipe and Fittings:

Pipe and fittings shall be in accordance with the requirements specified under "Pipe, Fittings and Valves," elsewhere in this Section 12-15.

Pipe and fittings for drain lines shall be as recommended by the valve manufacturer.

Pipe Hangers: Pipe hangers shall be of types listed as acceptable for specific applications in NFPA No. 13-1999.

Valves:

Valves shall be UL or FM listed, outside screw and yoke (OS&Y) rising stem type.

Valves (OS&Y) 2½ inches and larger in size shall be Crane, 467; Nibco Scott, F-607-0; or equal.

Valves (OS&Y) 2 inches and smaller in size shall be Crane, 459; Walworth, 873; Nibco Scott, T-104-D; or equal.

Optional; Valves 4 inches and larger may be butterfly type, UL or FM listed, working pressure 175 psig, gear operated, indicator flag, ductile iron body, bronze trim, with provisions for locking. Valve shall be provided with mounting block for supervisory switch. Supervisory switch shall not be included.

Supervisory Switch: Supervisory switch shall be UL or FM listed, for the type of valve supplied, single contact set with tamper resistant cover. Supervisory switch shall be suitable for exterior installations.

Sprinkler Head: Sprinkler head shall be upright type above ceiling and pendant type below ceiling. Sprinkler head shall be brass body, chemical or solder fusing type, with proper temperature rating element. Sprinkler head shall be Viking, Grinnell, Reliable, or equal.

Spare Sprinkler Cabinet: Spare sprinkler cabinet shall be metal cabinet as recommended by the sprinkler head manufacturer and conforming to NFPA requirements. The cabinet shall be painted red.

Fire Department Connection: Fire department connection shall be UL or FM listed, horizontal single or double Siamese as required, with 2½-inch inlets, drain cock, caps, chain, and brass nameplate. Inlets shall have national standard fire hose coupling screw threads. The fire department connection shall be Potter-Roemer, Grinnell, or equal.

Accessories: Drains, test connection, flush connections, pressure gauges, and other accessories shall be supplied as required.

Sign: Sign shall be sheet steel, not less than 0.030 inch (22-gage) thick, with red letters on a white background and a baked enamel coating.

PART 3 - EXECUTION

INSTALLATION

General: Sprinkler piping and equipment shall be installed in accordance with the approved working drawings and shall be located to avoid interference with the lighting system, access openings, other piping, HVAC ductwork or equipment. Sprinkler piping shall not be installed in openings intended for other work.

Reductions in pipe size shall be made with one piece reduction fittings. Bushings shall not be used.

Piping:

Fire sprinkler piping shall be installed level.

Drain piping and test connections shall discharge into the nearest floor drain or to the outside of the building. Discharge piping shall not drain across walkways.

Spare Sprinkler Cabinet: The spare sprinkler cabinet shall be installed where temperatures will not exceed 100°F at any time. Such location shall be approved by the Engineer. Six spare sprinklers and 2 sprinkler head wrenches shall be furnished and placed in the cabinet.

Securing Main Shutoff Valve: A galvanized chain, with a nominal material diameter of at least 7/32 inch, shall be provided to lock the main shutoff in the open position. The lock will be State-furnished as provided under "State-Furnished Materials" in Section 8, "Materials," of these special provisions.

Signs: Signs and messages shall be as required by NFPA No. 13 and the regulatory authorities having jurisdiction. Lettering shall be standard-type of the following heights:

Item	Minimum Lettering Height
Nameplate date	¼"
Drain signs	¾"
Tamper sign	¾"

FIELD QUALITY CONTROL

Acceptance Tests:

The Contractor shall arrange for testing of the automatic fire sprinkler system in the presence of the Engineer and the State Fire Marshal. Three days written notice of said testing shall be provided by the Contractor.

The system shall be pressure tested for 2 hours at 200 psig. A successful test shall have no visible leaks or loss of pressure.

The Contractor shall perform such other tests as may be required by the State Fire Marshal.

12-15.09 PLUMBING FIXTURES

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing plumbing fixtures in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Submit manufacturers' product data and illustrations of the specified fixtures and products.

Operation and Maintenance Data: Submit maintenance and operating instructions, including spare parts list, for plumbing.

Test Reports: Submit certified test results and certificates of compliance as necessary to verify conformance with specified requirements.

PART 2 - PRODUCTS

General: Plumbing fixtures shall be white in color and shall meet the following requirements:

Water Closet (Wall Hung with Flush Valve): Water closet shall be vitreous china, siphon jet, elongated bowl, wall hung, 1½-inch top spud, exposed flush valve and solid plastic open front seat with check hinges. Closet and accessories shall be of following types or equal:

	American Standard	Crane	Kohler
Closet	"Afwall" 2477.016	"Placidus" 3-446	"Kingston" K-4430-ET
Seat (except disabled accessible)	Church 5321.070	Olsonite 95	"Lustra" K-4670-C
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 1½-inch spud water closets.		
Carrier	Concealed closet chair carrier with 4-inch outlet connection. Zurn; J.R. Smith; Josam; Jonespec; or equal.		

Water Closet (Disabled Accessible, Wall Hung with Flush Valve): Disabled accessible water closet shall be vitreous china, wall hung, siphon jet, elongated bowl, 1½-inch top spud for exposed flush valve, with solid plastic open front elongated seat with check hinges. Water closet shall meet or exceed Americans with Disabilities Accessibility Act Guidelines (ADAAG) and ANSI Standards: A117.1 and A112.19.2. Closet and accessories shall be of the following types or equal:

	American Standard	Crane	Kohler
Closet	"Afwall" 2477.016	"Placidus" 3-446	"Kingston" K-4430-ET
Seat	Church 5321.070	Olsonite 95	"Lustra" K-4670-C
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with 1½-inch spud water closets.		
Carrier	Concealed closet chair carrier with 4-inch outlet connection. Zurn; J.R. Smith; Josam; Jonespec; or equal.		

Urinal (Disabled Accessible): Urinal shall be vitreous china, wall hung, siphon jet or washout, top spud, integral shields, spreader and trap, with 15-inch maximum extension from wall. Urinal and valve shall meet Americans with Disabilities Accessibility Act Guidelines (ADAAG) and shall be of following types or equal:

	American Standard	Crane	Kohler
Urinal	"Allbrook" 6540.017	"Manhattan" 7-109	"Bardon" K-4960-T
Flush valve	Exposed, diaphragm type, chrome plated, with oscillating handle, integral control stop, adjustable tail piece and vacuum breaker suitable for use with top spud urinals.		

Lavatory (Counter Mounted): Lavatory shall be self-rimming vitreous china, integral perforated grid drain, drilled for 4-inch centers, nominal bowl size 10" x 18", with single extra long lever mixing faucet. Lavatory shall be equipped with temperature controls to limit the hot water supply to 110°F. Lavatory shall be equipped with a flow limiting device that limits the flow rate of hot water to no more than 0.5 GPM. Lavatory and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Lavatory	"Aqualyn" 0476.028	"Kathy" 051-3334	"Rondelle" K-2185
Drain	2411.015	803-052	K-7715
Supplies	Brass Craft FR1711C	801-0111	K-7606
Faucet	Moen 8425	------	15592-5
Trap	1¼-inch chromium plated brass exposed bent tube adjustable 17-gage minimum thickness.		

Mop Sink: Mop sink shall be acid resisting enameled cast iron, 28" x 28" outside dimensions, 3-inch trap, vinyl coated rim guard, vacuum breaker faucet with hose and wall hook. Sink and accessories shall be of the following types or equal:

	American Standard	Eljer	Kohler
Mop sink	"Florwell" 7740.020	"Custodial" 242-0050	"Whitby" K-6710
Strainer	7721.038	803-0630	K-9146
Faucet	8344.111	749-1450	K-8928

Accessible Sink: Accessible sink shall be constructed of 18-gage minimum stainless steel with full undercoating. Sink shall be ADA compliant, single compartment, self-rimmed with ledge for faucet. Nominal bowl size shall be 25 inch x 21-inch minimum with an outside nominal depth of 5 inch or less. Sink shall be supplied with stainless steel strainer, chrome P-trap. Sink faucet shall be metal body, chrome plated, single lever mixing type with 10-inch gooseneck swing spout aerator and replaceable cartridge.

Sink	Moen 22130	Elkay Celebrity GECR2521L	---
Trap	American Standard 7798.176	Eljer 804-1060 w/strainer	Kohler K-6673 w/strainer
Faucet	Matco-Norca AE-295	Delta 172-SSWF	Chicago 2304-CP

Electric Water Heater: Electric water heater shall be instant type, 115 –volt or 208-volt as required, minimum capacity as shown on plans, designed for minimum 100 psig, Eemax, PowerStar, or equal.

Water Heater (Gas):

Water heater shall be minimum capacity as shown on plans, designed for minimum 125 psig, glass lined, and equipped with gas pressure regulator, magnesium anodes, cold water drop tube, high temperature energy shut-off device, valved drain, high density R-8 minimum foam insulation and finished with a steel jacket with baked enamel finish. Water heater shall meet the requirements of the California Energy Commission.

Water heater shall be equipped with an ASME labeled, tank mounted, pressure and temperature relief valve sized for maximum input.

Electric Water Cooler (Wall Mounted):

Electric water cooler shall be wall mounted, simulated recessed, and shall produce a minimum of 7.6 gallons of 50°F water per hour based on an inlet water temperature of 80°F and an ambient room temperature of 90°F. Cooler shall have self-closing, pushbutton bubbler with guard, automatic stream regulator, loose key stop, adjustable thermostat, and cast brass P-trap. Compressor shall be hermetically sealed, positive start with fan cooled condenser. Electric water cooler shall be provided with 3-wire grounded cord and plug.

Electric water cooler shall have stainless steel top and steel cabinet with baked enamel finish.

Electric water cooler shall be Haws, HWSR8; Elkay, EHF-8; Sunroc, PSR-8; or equal.

Electric Water Cooler (Disabled Accessible, Wall Mounted):

Electric water cooler shall be wall mounted, wheelchair accessible, and shall produce a minimum of 7.6 gallons of 50°F water per hour based upon an inlet water temperature of 80°F and an ambient room temperature of 90°F. Cooler shall have self closing, front and side mounted pushbar actuators, shielded bubbler, automatic stream regulator, loose key stop, adjustable thermostat and cast brass P-trap.

Compressor shall be hermetically sealed, positive start with fan cooled condenser and shall be mounted above the cooler top. Cooler shall be provided with 3-wire grounded plug and cord.

Electric water cooler shall be Haws, HWCA8D; Sunroc, HCWC-8S; Elkay, EHFS-8; or equal.

Emergency Eyewash and Shower:

Handicapped accessible combination emergency eye/face wash and shower safety station conforming to ANSI Z358.1 with emergency markings conforming to ANSI Z535.1.

Emergency eyewash and shower shall be separate drench shower and eye bath, 1¼-inch minimum, galvanized steel pipe stand with 9-inch floor mounting flange and equipped with 8½" x 11" pictorial and worded emergency identification sign.

Shower head with a 10 inch diameter ABS plastic head with a stay-open ball valve operated by a rigid pullrod with triangular handle. Extended showerhead and pullrod for ADA compliant access.

Eyewash shall have a 11 ½ inch diameter stainless steel bowl lowered and extended for wheelchair accessibility, anti-surge heads and circular chrome plated spray ring to bathe the entire face, dust cover assembly, and a stay-open ball valve operated by a flag handle.

Expansion Tank: Expansion tank shall be of welded steel construction and shall be ASME inspected and stamped for 125 psig working pressure. The tank shall be equipped with drain valve, air charging valve, and gauge glass. Expansion tank shall have the capacity shown on the plans.

Circulator Pumps:

Circulator pumps shall be close coupled type with non-overloading characteristics. Pumps shall not overload the motor above its horsepower rating under any operating conditions with the ratings based on continuous operation. Motor sizes shown are estimated minimum requirements and larger motors shall be furnished if necessary to meet non-overloading requirements. Motors shall have built-in overcurrent protection.

Pump material shall be compatible with the working fluid, and shall be sized to meet the operating requirements specified.

Circulator pumps shall be Grundfos, Bell and Gosset, or equal. Pumps shall be designed especially for these type of installations. Each pump shall have a cast iron case, bronze impeller, mechanical seal, and flanged connections to permit easy removal of the complete unit from the piping system.

PART 3 - EXECUTION

INSTALLATION

All finish for exposed metal on any fixture, including wall flanges, bolts, nuts and washer, shall be polished chrome plated.

Fixtures shall be sealed to wall or floor with silicone caulk bead.

All exposed metal surfaces on fixture supports shall be enameled to harmonize with fixtures.

Wall mounted fixtures shall be installed on concealed chair carriers designed to support weight of fixture from the floor, made for the specific fixture to be supported and for the particular installation conditions.

All fixtures, including showers, shall be provided with accessible metal stop valves.

Hot water supply, trap and tailpiece on lavatories shall be wrapped with insulating material.

Flush valves for fixtures designated on the plans as disabled accessible shall be installed so that the valve handle is on the widest side of the toilet space.

Water heater shall be installed with seismic restraints, inlet ball valve and insulating connections, and ¾-inch pressure and temperature relief drain pipe.

Circulator pumps shall not be connected to the piping before the piping is thoroughly flushed and cleaned of dirt and grit. After the connections have been made, the system shall be filled before starting the pumps. Circulator pumps shall not be run dry under any circumstances.

Piping shall be supported from the building structure to prevent strain on the pump casings. A final check for alignment of the piping connections shall be made after the pump has been secured.

FIXTURE MOUNTING HEIGHTS

Unless otherwise noted, fixtures shall be mounted at the heights shown on the plans.

Service Sink: Service sink double faucet shall be mounted on wall above sink back with spout outlet face 16 inches above service sink rim.

Mop Sink: Mop sink double faucet shall be mounted on wall above sink back with spout outlet face 36 inches above the floor.

Emergency Eyewash and Shower: Emergency eyewash and shower shall be installed with a rigid bracket located 48 inches above the floor. Bracket shall be minimum 16-gage steel and shall be braced to the wall.

FIELD QUALITY CONTROL

Testing:

The Contractor shall test piping in accordance with the requirements specified elsewhere in these special provisions.

All installed fixtures shall be tested for proper operation after all plumbing work has been completed.

12-15.10 SHOWER STALL

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a shower stall in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, installation instructions and color palette shall be submitted for approval. The color and finish will be selected from the manufacturer's standard product line by the Engineer after the award of the contract.

PART 2 - PRODUCTS

Shower Stall: Shower stall shall be single unit, one-piece construction, fabricated from glass fiber reinforced polyester resin and provided with the following fittings and accessories: soap dish, chromium plated metal or stainless steel curtain rod, chromium plated steel showerhead with ball joint, chromium plated steel bent arm and wall flange, chromium plated metal outlet drain with removable strainer, chromium plated single-handle control thermostatic mixing valve that has control cartridge with no metal to metal wearing surfaces, and vinyl plastic shower curtain with noncorrosive curtain hooks. .

PART 3 - EXECUTION

INSTALLATION

The shower stall shall be installed in accordance with the manufacturer's recommendations. Installation shall be sealed and caulked watertight.

12-15.11 HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT AND SYSTEMS

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing, installing and testing heating, ventilating, air conditioning (HVAC) systems in accordance with the details shown on the plans and these special provisions.
Related Work:

Temperature controls such as thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the heating, ventilating and air conditioning equipment. All temperature control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

Ductwork and fans for Dust Collection System shall be as specified elsewhere in these special provisions..

Testing, adjusting and balancing of HVAC equipment shall be as specified elsewhere in these special provisions..

SUBMITTALS

Product Data: Product literature and installation instructions shall be submitted for all products proposed excluding duct work.

Working Drawings: Submit Working Drawings indicating plans, elevations, and sections; dimensions and weights of equipment; electrical connections; wiring diagrams; control logic diagrams (sequence of events) if applicable, product data for instruments and controls; safety devices; interlocks; and mounting bases.

QUALITY ASSURANCE

Codes and Standards:

Equipment and systems shall conform to California State Energy Commission Regulations and, where applicable, shall be American Refrigeration Institute (ARI), American Gas Association (AGA), Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and Air Movement and Control Association (AMCA) approved for performance ratings and application shown on the plans.

Any appliance for which there is a California standard established in the Appliance Efficiency Standards may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standards for that appliance. Space conditioning equipment may be installed only if the manufacturer has certified that the equipment meets or exceeds all applicable efficiency requirements listed in the Energy Efficiency Standards.

PART 2 - PRODUCTS

HEATING AND COOLING UNITS

Fan Coil Unit (FC):

FC cabinet shall be manufactured of heavy gauge galvanized steel. The entire cabinet shall be insulated with two-inch thick IAQ type insulation. The insulation must meet the requirements of ASTM C 1071, ASTM G 21, ASTM G 22, NFPA 90A and UL-181. Removable access panels shall be provided on both sides of the cabinet for maintenance and service.

Blowers shall be resiliently mounted, with ball bearings, forward curve blade, and of centrifugal type. Each wheel shall be dynamically balanced for smooth, quiet operation. Blowers shall be belt driven with field adjustable pulleys to permit variations in static pressure and air requirements. The fan and fan motor shall provide the specified air flow, with wet coil, against the external static pressure as noted on the plans. All units shall operate at the voltages and phase(s) specified on the plans.

Coils shall be aluminum fins bonded to seamless copper tubing. Coils shall be leak tested at 350 PSIG minimum air pressure. Manual air vents shall be provided. Drain pans shall be coated for corrosion protection.

Filters shall be accessible without tools. Two inch filters shall be provided on all units.

Fan Coil Units shall be provided with an economizer.

Fan coil units shall be First Company Model SHW, York Model YSHW or approved equal.

Economizer: Economizer shall be modulating type assembly either provided by the manufacturer or fabricated to match the unit. The economizer shall be complete with damper motor and linkage for full range modulation of the outdoor and return air dampers, minimum position damper control, installed in an enclosure similar in color to the basic unit with paint applied by the manufacturer of the economizer. The economizer shall be constructed to meet SMACNA requirements and working drawings shall be submitted prior to fabrication.

Air Conditioner (Ductless): Air conditioner shall consist of an outdoor condenser unit with an indoor fan/coil unit. The condenser unit shall consist of a rotary type compressor, condensing coil, fan and all controls, tubing and appurtenances required for a complete operating system. The indoor fan coil units shall consist of an evaporating coil, expansion control device, propeller fan, auxiliary electric heat strips and thermostat. In addition, the indoor unit shall come with a plug or local disconnect. The system shall provide heating or cooling as required by the thermostat. Units shall be Sanyo, Mitsubishi Electric, Toshiba, or equal.

HEAT EXCHANGER

Heat exchanger: Heat Exchanger shall be plate and frame type meeting the requirements as specified on the plans with the capability to expand the transfer capacity to twice the current rating.

AUXILIARY HVAC COMPONENTS

Unless specified herein, all components shall be sized and have the characteristics as shown on the plans.

Rigid Ductwork: Galvanized steel sheet metal conforming to the latest edition of the SMACNA "Low Velocity Duct Construction Standards." Galvanized steel shall be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.

Spiral Duct: Spiral duct shall be prefabricated type.

Duct Supports: Duct supports shall be hot-dip galvanized steel.

Flexible Ductwork: Flexible ductwork shall be UL 181, Class 1 air duct rated and shall meet the requirements of NFPA 90-A. Duct shall have steel helix wire, flexible insulation, minimum thermal resistance of R-8, and flame resistant vapor barrier. Inner and outer surfaces shall be non-metallic. Outer surface shall be Copolymer or Mylar, factory applied.

Flexible Connection: Flexible connection shall be prefabricated type and shall be commercial quality flexible glass fabric coated on both sides with neoprene or hypalon.

Ceiling Diffuser (except suspended ceilings): Ceiling diffuser shall be rectangular or square type. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, equipped with a removable core and a standard flanged frame with sponge rubber or felt gasket. Diffuser shall have individually adjustable curved blades, counter-sunk screw holes, shall be surface mounted, with face velocity less than 600 feet per minute; Titus, Air Mate, Hart and Cooley, or equal.

Return Grille (For Gypsum Board Ceilings): Return grille for gypsum board ceilings shall be rectangular or square, and shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, fixed bar type, die formed louvers set at 45 degrees, ½-inch spacing maximum, surface mounted; Titus, Air Mate, or equal.

Ceiling Diffuser (for Suspended Ceilings): Ceiling diffuser for Suspended ceilings shall be 24 inches square. Diffuser shall be steel with oven baked-on enamel bone white dull finish or extruded aluminum, perforated face hinged for easy access, and shall be fitted with fully adjustable air pattern controllers, a removable core, and a standard flanged frame; Titus, Air Mate, or equal.

Return Register (for Suspended Ceilings): Return register for Suspended ceilings shall be 24 inches square, steel or extruded aluminum, perforated face hinged for easy access; Air Mate, Titus, or equal.

Wall Supply Register: Wall supply register shall be double-deflecting adjustable type, with vertical face bars and horizontal rear louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Titus Hart and Cooley Air Mate or equal.

Wall Return Register: Wall return register shall be single deflecting type, with horizontal adjustable louvers, steel with oven baked-on enamel bone white finish or extruded aluminum, flanged frame with sponge or felt gasket; Titus Hart and Cooley, Air Mate, or equal.

Volume Damper: Volume damper shall be opposed blade type, operable from face with screw driver or Allen-head wrench, shall be same manufacturer as diffuser or may be furnished as part of the diffuser.

Fresh Air Intake: Fresh air intake shall be curb mounted unless otherwise shown with a pressure drop not to exceed 0.10 inches W.C. at the maximum rated flow as shown on the plans, Intake to have a stainless steel or aluminum bug screen. Construction shall be aluminum as manufactured by Greenheck, Cook or equal.

Balance Damper: Balance damper shall be butterfly type, 16-gage (minimum) galvanized steel blade, end bearings with steel shaft and locking and indicator operator. Balance damper shall be Ventlock, Young, Anemostat, or equal.

Air Filter (for HVAC Units): Air filter shall be permanent metal viscous impingement type, constructed of aluminum or galvanized steel, 2-inch minimum thickness and be approved for Class 2 use. Filter shall have a minimum efficiency rating of 50 percent as determined when tested in accordance with ASHRAE Test Standard 52. Filter shall be mounted in 16-gage galvanized steel holding frames. Two cans of recharging adhesive shall be provided with the filter and shall be nearly odorless, have a high flash point, rapid wetting characteristics, dye tracer and be water soluble. Filter shall be Airspan, Type AF, Eco-Air Products, Inc., Type HIA; Snyder General, Type AAF; or approved equal.

Vents and Flues: Vents and flues for boilers and water heaters shall be approved Type B.

Refrigerant and Condensate Drain Piping: Refrigerant and condensate drain piping shall be rigid, Type L copper tubing with brazed solder fittings. The suction line shall be insulated, with vapor barrier and shall be weatherproofed for exterior installation. Factory sealed tubing shall not be used.

PART 3 - EXECUTION

INSTALLATION

Fan Coil Units: Fan Coil Units shall be suspended as shown on the plans.

Ventilators:

Condensate Drains: Fan Coil units and heat pumps shall be provided with condensate drain trap and piping as shown on the plans. A pan with secondary piping shall be provided on all fan coil units over suspended ceilings. Air gap shall be installed where required by code. Interior condensate drain piping shall be insulated with foam insulation.

Air Outlets: Volume dampers shall be furnished and installed for all diffusers. Blocking shall be provided on all sides of air outlets between ceiling or wall joists. Collars shall be supplied for all outlets and shall be taped and sealed in place.

Vents and Flues: Vents and flues shall be securely fastened to the building construction, shall be provided with a collar at all ceiling penetrations and shall terminate with a weather cap fabricated of the same material.

Access Door: Access doors shall be provided in rigid ducts and plenums for access to volume dampers, fire and smoke dampers and control devices located within such ductwork; and shall be provided at such other locations as shown on the plans.

Ducts and Vents:

Ductwork within the building shall be installed to clear lighting fixtures, doors, windows and other obstructions. Ductwork shall preserve head room and shall keep openings and passageways clear whether shown on plans or not.

Ductwork shall be installed and braced according to the latest edition of the SMACNA "HVAC Duct Construction Standards."

Slopes in sides at transitions shall be approximately one to five. The ductwork system shall not contain abrupt changes or offsets of any kind unless otherwise shown on the plans.

Where ducts pass through walls, floors or ceilings, galvanized sheet metal or steel angle collars shall be installed around the ducts.

Duct sections shall be connected by beaded sleeve-type couplings using joint sealer as recommended by the duct manufacturer. Duct sections shall be mechanically fastened with pop rivets or sheet metal screws and sealed with mastic or insulated, reinforced silver tape.

Flexible connections shall be provided at both inlet and outlet of fan coil and ventilating units.

Sheet metal plenums shall be adequately braced and supported from the floor or structure with structural steel angles to prevent sagging, flexing and vibration.

All standing seams and transverse joints of supply, return and exhaust ducts and seams around plenums, fan and coil housings shall be sealed with sealant and taped.

12-15.12 HYDRONIC PIPING

PART 1 – GENERAL

SUMMARY

Scope: This work includes above ground, interior piping systems for hot water heating, chilled water cooling, and condensate drain piping. Piping materials and equipment specified in this section include pipes, fittings, special duty valves, and hydronic specialties.

Related Work:

Temperature controls such as thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the hydronic equipment. All temperature and control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

Testing, adjusting and balancing of hydronic equipment shall be as specified elsewhere in these special provisions..

Underground hydronic piping shall be as specified elsewhere in these special provisions..

Insulation for hydronic piping shall be as specified in “Pipe Insulation” elsewhere in these special provisions..

Nameplates shall be as specified elsewhere in these special provisions..

SYSTEM DESCRIPTION

General: The hydronic piping systems are the "water-side" of an air-and-water heating and air conditioning system. These systems are classified by ASHRAE as Low Water Temperature, Forced, and recirculating systems.

SUBMITTALS

Product Data: Submit manufacturer's technical product data for all piping and equipment, including hydronic specialty and special duty valves specified. Include rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions. Furnish flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.

Working Drawings: Submit working drawings detailing dimensions, weight loadings, required clearances, methods of assembly of components, and location and size of each field connection.

Coordination Drawings: Provide coordination drawings for all chiller room, boiler room, installations that include all major equipment, valves and accessories.

Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for hydronic specialties and special duty valves, for inclusion in operating and maintenance manuals. Include parts and special tools lists.

PART 2 - PRODUCTS

PIPE AND TUBING MATERIALS

Copper Tubing: ASTM B 88, Type L, drawn temper copper tubing with wrought copper fittings and solder joints 2 inches and smaller, above ground, within building. Use type K, annealed temper copper tubing for 2 inches and smaller without joints, below ground within slabs. Mechanical fittings (crimp or flair) are not permitted.

Steel Pipe: ASTM A 53, Schedule 40, with threaded joints and fittings for 2 inches and smaller, and with welded joints for 2 1/2 inches and larger. End seals shall be factory applied, sealed to the jacket and the carrier pipe.

FITTINGS

Steel Fittings: ASTM A 234, seamless or welded, for welded joints.

Flexible Connectors: Pipe size 1 1/2 inches and smaller shall have flexible hose connectors consisting of a corrugated inner metal hose wrapped with a wire protective braid; hose and braid to be stainless steel. Pipe size 2 inches and larger shall have rubber expansion joints of the single or double arch type, constructed of an EPDM molded rubber cover. Joints shall have flanges integral with the body. Each joint shall be furnished with ANSI 125# drilling and flanges and solid 3/8 inch thick galvanized steel retaining rings. All units shall be suitable for working pressures up to 150 psig.

Pipe Expansion Fittings and Loops: Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature. Attach pipe bends and loops to anchors. Expansion fittings for pipes 2 ½ inches to 4 inches: Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F minimum pressure ratings**.**

Steel Anchors: Attach by welding. Comply with ASME B31-9 and ASME Boiler and Pressure Vessel Code: Section IX, 'Welding and Brazing Qualifications."

SPECIAL DUTY VALVES

Calibrated Plug Valves: 125 psig water working pressure, 250°F maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inches and smaller shall have threaded connections and 2 1/2 inches valves shall have flanged connections. Acceptable manufacturers include Bell & Gossett ITT (Fluid Handling Div.), Taco, Inc., and Thrush Products, Inc or equal.

Butterfly Valve: Butterfly valve shall be flanged, ferrous-Alloy butterfly valves. Valve rating shall be for tight shutoff, 200 psig, with disc and lining suitable for hot and chilled water applications. Acceptable manufacturers include shall be Bray International, Grinnell Corporation, or equal.

Triple Duty Valves: 200 psig working pressure, 300°F maximum operating temperature, cast-iron body, bronze disc and seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have flanged connections and straight or angle pattern as indicated. Features shall include non-slam check valve with spring loaded weighted disc, and calibrated adjustment feature to permit regulation of pump discharge flow and shutoff. Acceptable manufacturers include Amtrol, Inc., Bell & Gossett ITT (Fluid Handling Div.), and Taco, Inc or equal.

Circuit Balancing Valves: Bronze body for valve sizes 1/2 inch to 2 inches, ductile iron body for valve sizes 2 1/2 inches to 12 inches. Each valve shall be equipped with two 5/16 inch metering ports with EPT check valves. Valves are modified, equal percentage globe valves with memory locks, which provide three functions: flow measurement, flow balance and positive drip tight shutoff. Valves provided with multiturn adjustment (1440o min.). Acceptable manufacturers include Amtrol, Inc., Bell & Gossett ITT (Fluid Handling Div.), or equal.

Control Valve:

Control valve shall be furnished with an electronic positioner type actuator. Valve body shall be ductile iron ASTM A536, and all internal cast components shall be ductile iron or CF8M (316) stainless steel. All ductile iron components, including the body and cover, shall be lined and coated with an NSF and FDA approved epoxy coating applied by the electrostatic heat fusion process. All main valve trim and throttling components (cover bearing, valve seat and disc guide) shall be stainless steel.

The TCV shall be sized for a 5 foot maximum drop at the flow shown on the plans.

Electronic positioner shall be direct acting, 100% solid state, 120V, 60 Hz. Operation of the valve positioner shall be based on the comparison of 2 voltages-one derived from the input signal and other from the feedback potentiometer driven by the actuator shaft. Torque rating of the actuator shall be selected to operate the valve selected.

HYDRONIC SPECIALTIES

Manual Air Vent: Manual air vent shall be as detailed on the drawings.

Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure, 240°F operating temperature; and having 8mm discharge connection and 1/2 inch inlet connection. Acceptable manufacturers include Armstrong Machine Works, Bell & Gossett ITT (Fluid Handling Div.), Hoffman Specialty ITT (Fluid Handling Div.), and Spirax Sarco or equal.

Expansion Tanks: Expansion tank shall be a full acceptance pre-charged bladder tank. Size and number shall be as indicatedon the plans. Tanks shall be constructed of welded carbon steel for 125 psig working pressure, 375°F maximum operating temperature. Provide taps for pressure gauge and air charging fitting, and drain fitting. Tank, with taps and supports, shall be constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, and Division 1. Acceptable manufacturers include Bell & Gossett, Amtrol, Inc., Armstrong Pumps, Inc., and Taco Inc or equal.

Chemical Feeder: Bypass type chemical feeders of five gallon capacity, welded steel construction; 125 psig working pressure; complete with fill funnel and inlet, outlet, and drain valves. Chemicals shall be specially formulated to prevent accumulation of scale and corrosion in piping system and connected equipment, developed based on a water analysis of make-up water. Acceptable manufacturers include Culligan USA, Vulcan Laboratories (Subsidiary of Clow Corp.), and York-Shipley, Inc or equal.

Y-Pattern Strainers: Cast-iron body (ASTM A 126, Class B), flanged ends for 2 1/2 inches and larger, threaded connections for 2 inches and smaller, bolted cover, perforated Type 304 stainless steel basket, bottom drain connection; 125 psig working pressure. Acceptable manufacturers include, Amtrol Inc., Armstrong Pumps, Inc., Bell & Gossett (Fluid Handling Div.), and Taco, Inc or equal.

Air Separators: Steel tank, centrifugal type air separator with tangential inlet and outlet connections. Unit shall have separate top fittings for connection to system make-up water and for air vent. There shall be a bottom connection for blowdown cleaning. Unit must be constructed in accordance with the ASME boiler and pressure vessel code and stamped 125 psig design pressure. Acceptable manufacturers include Amtrol, Inc., Armstrong Pumps, Inc., Bell & Gossett ITT (Fluid Handling Div.), and Taco, Inc or equal.

PART 3 - EXECUTION

PIPING INSTALLATIONS

Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.

Install unions in pipes 2 inches and smaller, adjacent to each control valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices. Install flanges on valves, apparatus, and equipment having 2 1/2 inches and larger connections.

Anchor piping to ensure proper direction of expansion and contraction.

JOINTS

Comply with recommended industry practice for preparation and assembly of soldered, threaded, welded, and flanged joints.

Comply with the procedures contained in the AWS "Brazing Manual" for brazed joints.

WELDING

Pipe welding shall comply with the provisions of the latest Revision of the Applicable Code, whether ASME Boiler Construction Code, ASA Code for Pressure Piping, or such state requirements as may supersede codes mentioned above.

VALVE APPLICATIONS

General Duty Valve Applications where specific valve types are not indicated, the following requirements apply:

Shut-off duty, use gate, ball, and butterfly valves

Install shut-off duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.

Use globe valves for throttling and control duty.

Install throttling duty valves at locations indicated.

Install circuit balance valves on each heating or cooling element and elsewhere as required to facilitate system balancing.

Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

Install triple duty valves on each pump discharge and elsewhere as required to control flow quantity.

Install safety relief valves on all hydronic systems, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for installation requirements.

Install pressure reducing valves on inlet water line, and elsewhere as required to regulate system pressure.

HYDRONIC SPECIALTIES INSTALLATION

Install manual air vents at all high points in the system; at heat transfer coils, and elsewhere as required for system air venting.

Install triple duty valves in horizontal or vertical position with stem in upward position. Allow clearance above stem for check mechanism removal.

Install shot-type chemical feeders in hydronic system; in upright position with top of funnel not more than forty-eight inches above floor. Install feeder in bypass line, off main using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

Install full acceptance bladder tank as shown on contract plans. Vent and purge air from hydronic system; charge tank.

Expansion fitting installation:

1. Install expansion fittings according to manufacturer's written instructions.

2. Install expansion fittings in sizes matching pipe size in which they are installed.

3. Align expansion fittings to avoid end loading and Torsional stress.

FIELD QUALITY CONTROL

Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:

1. Leave joints including welds uninsulated and exposed for examination during the test.

2. Provide temporary restraints for expansion joints, which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.

5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

Testing: Test hydronic piping as follows:

1. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workers and compatible with the piping system components.

2. Use vents to release trapped air while filling the system.

3. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.

4. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 100 psig. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B 31.9, Code For Pressure Piping, Building Services Piping.

5. After the hydrostatic test pressure has been applied for at least ten minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

ADJUSTING AND CLEANING

Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic-piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.

Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.

All un-insulated piping shall be completely cleaned and painted. The Engineer will determine paint color.

12-15.13 UNDERGROUND PREINSULATED HYDRONIC PIPING

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing underground preinsulated hot water and chilled water supply and return pipes, fittings, valves, expansion devices, and anchors in accordance with the details shown on the plans and these special provisions. Pipe, fittings and valves shall include such piping accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the piping system.

The pipe sizes shown on the plans are nominal inside diameter. No change in the pipe size shown on the plans shall be permitted without written permission from the Engineer.

The pipe and fitting classes and material descriptions shall be as specified herein. No change in class or description shall be permitted without written permission from the Engineer.

Related Work: Trenching shall be in accordance with the requirements specified under "Earthwork for Building Work," in Section 12-2, "Site Work," of these special provisions.

SUBMITTALS

Product Data: Manufacturer's descriptive data, and installation instructions shall be submitted for approval.

QUALITY ASSURANCE

Codes and Standards: Preinsulated pipe, fittings and valves shall be installed in accordance with the requirements in the latest edition of the Uniform Plumbing Code, Uniform Mechanical Code, and the manufacturer's recommendations and the requirements specified herein.

PART 2 - PRODUCTS

Under Ground Hydronic Pipe: The service pipe shall be standard weight ASTM A53 carbon steel. All joints shall be butt-welded. Where possible, straight sections shall be supplied in 40-foot random lengths with piping exposed at each end for field joint fabrication.

Accessories: Elbows, tees, reducers, expansion devices, anchors, field joints, and end caps shall be designed and factory fabricated for the piping system.

INSULATION

The underground hydronic pipe insulation shall be polyurethane foam with 2 lb/ft^3 minimum density, 90% minimum closed cell content, minimum compressive strength of 40 psig and initial thermal conductivity of 0.16 $Btu\text{-}in/hr/ft^{2/O}F$. The insulation thickness for the hot and chilled water piping shall be 1-1/2”. The insulation shall completely fill the annular space between the service pipe and jacket and-shall be bonded to both. Systems using open cell insulation or a non- bonded design shall not be allowed. The polyurethane foam insulation shall be tested by the manufacturer for mechanical and thermal properties to assure compliance with the above values. All test samples will be taken from production material, identified, tagged and tested in accordance with the table below. Test reports showing results will be furnished to the engineer for approval. Data supplied by the polyurethane foam chemical supplier is not acceptable.

Attribute	ASTM STD	Sample Frequency	Requirement
Insulation Density	D 1622	Once per shift	> 2 lb/ft^3
Insulation Compression Strength	D 1621	Once per shift	> 40 psig
Insulation Closed Cell Content	D 2856	Once per shift	> 90%
Insulation Thermal Conductivity	C 518	Once per shift	< 0.16 Btu-in/hr/ft^2/°F

Insulation Jacket: The outer protective insulation jacket shall be seamless high-density polyethylene (HDPE) in accordance with ASTM D1248, type 3, Class C. PVC or tape materials are not allowed. The minimum thickness of the HDPE jacket shall be 1/8".

Fittings: All fittings shall be factory prefabricated and pre-insulated. Straight tangent lengths shall be added to all ends so that all field joints are at straight sections of pipe. Elbow jackets shall be molded HDPE. Tee jackets shall be extrusion welded or butt fusion welded HDPE. Gluing, taping or hot air welding shall not be allowed.

PART 3 - EXECUTION

INSTALLATION

FIELD JOINTS

After an acceptable hydrostatic test of the piping system the insulation shall then be poured in place into the field joint area. All field-applied insulation shall be placed only in straight sections of pipe. Field insulation of fittings is not acceptable. The installer shall seal the field joint area with a heat shrinkable adhesive backed sleeve. Backfilling shall not begin until the heat shrink sleeve has cooled. All insulation and jacketing materials for the field joint shall be furnished by the piping manufacturer.

BEDDING AND BACKFILL

A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the pipe. The entire trench width shall be evenly backfilled with a similar material as the bedding in 6 inch compacted layers to a minimum height of 6 inches above the top of the insulated pipe. The remaining trench shall be evenly and continuously backfilled and compacted in uniform layers with suitable excavated soil. No backfilling shall take place until an acceptable hydrostatic test has been achieved.

PIPE SLEEVES

The Contractor shall provide sleeves, inserts and openings necessary for the installation of pipe, fittings and valves. Damage to surrounding surfaces shall be patched to match existing.

PVC pipe sleeves shall be provided where each pipe passes through non fire rated concrete floors, footings, walls or ceilings. Inside diameter of sleeves shall be at least ¾ inch larger than outside diameter of pipe. Sleeves shall be installed to provide at least 3/8-inch space all around pipe the full depth of concrete. Space between pipes and pipe sleeves shall be caulked watertight.

MISCELLANEOUS

Cutting Pipe: Pipe shall be cut straight and true and the ends shall be reamed to the full inside diameter of the pipe after cutting.

Cleaning and Closing Pipe: The interior of all pipes shall be cleaned before installation. All openings shall be capped or plugged as soon as the pipe is installed to prevent the entrance of any materials. The caps or plugs shall remain in place until their removal is necessary for completion of the installation.

Flushing Completed Systems: All completed systems shall be flushed and blown out.

Expansion Devices: Expansion devices shall be designed and installed in accordance with the pipe manufacturers recommendations and instructions.

FIELD QUALITY CONTROL

TESTING

The Contractor shall test piping at completion of roughing in, before backfilling and insulation field joints, and at other times as directed by the Engineer. The system shall show no loss in pressure or visible leaks.

During testing valves shall be closed and the pipeline filled with water. Provisions shall be made for the release of air.

The system shall be tested as a single unit, or in sections as approved by the Engineer. The Contractor shall furnish necessary materials, test pumps, instruments and labor and notify the Engineer at least 3 working days in advance of testing. After testing, the Contractor shall repair all leaks and retest to determine that leaks have been stopped. Surplus water shall be disposed of after testing as directed by the Engineer.

The Contractor shall take precautions to prevent joints from drawing while pipes and appurtenances are being tested. The Contractor shall repair damage to pipes and appurtenances or to other structures resulting from or caused by tests.

The underground hydronic pipe shall be hydrostatically tested to 150 psig.

12-15.14 BOILER

PART 1 - GENERAL

Scope: This work shall consist of furnishing, installing and testing a heating hot water boiler, exhaust flue and associated equipment and systems in accordance with the details shown on the plans and these special provisions.
The performance rating and electric service of the boiler equipment shall be as shown on the plans.

SUBMITTALS

Product Data: Submit manufacturer's product data indicating total installation instructions, assembly support details, thermal loads, motor horsepower, electrical characteristics, sequence of operation, connection requirement, performance curves, start-up instruction and installation, testing procedure instructions.

Working Drawings: Submit Working Drawings indicating plans, elevations, and sections; dimensions and weights of equipment; electrical connections; wiring diagrams; control logic diagrams (sequence of events) product data for instruments and controls; safety devices; interlocks; and concrete pads.

Performance and Testing Data: Performance rating shall be in accordance with HI – Testing and Rating Standard for Cast Iron and Steel Heating Boilers. Minimum Efficiency shall be 80 percent from 30 to 100 percent of full load firing rate. Efficiency and capacity shall be certified by factory. In addition to factory certified capacity and efficiency tests, the boilers shall be performance tested by the factory to check construction, controls, and operation or unit. Submit copies of inspection report to Engineer prior to shipment.

Operation and Maintenance Data: Submit manufacturer's printed operation and maintenance instructions, describing operating procedures and maintenance sequences. Include manufacturer's recommended spare parts list for maintenance requirements.

Warranties: Submit the respective manufacturer's warranty, warranting the performance of the equipment for a two-year period following final acceptance of the work, and for a 12-month period after the equipment is put into normal and continuous operation. Furnish labor, materials and equipment to adjust the air conditioning and heating equipment during the warranty period.

QUALITY ASSURANCE

Provide products and installation conforming to NFPA 70, National and the California Electrical Code; ASHRAE 15, and the California Mechanical Code.

Provide products of manufacturers specializing in the manufacture of boiler equipment, that can show evidence of having produced boiler equipment of approximately the same required capacity, and has been in successful operation for at least ten years.

Equipment shall be manufactured and tested in accordance with applicable UL requirements.

SITE CONDITIONS

Examine surfaces and structures where equipment will be installed before the Work of this Section begins, assuring that the surfaces are capable of supporting the weight of the equipment. Surfaces that will become inaccessible after the equipment installation shall be completed before the equipment is installed. Assure that electrical facilities and services, that serve the equipment, have been installed, tested, and approved before installation of equipment.

PART 2 - PRODUCTS

GENERAL PRODUCT REQUIREMENTS

Disconnect switches, where provided, shall be accessible from outside control panel with control circuit transformer wired on disconnected side of the switch.

HOT WATER BOILERS

General: Furnish and install factory assembled, factory fire-tested, self contained, readily transported steel membrane wall flexible water tube boiler ready for automatic operation except for connection of water, fuel, electrical, and vent services. The hot water boiler shall be mounted on integral structural steel frame base with integral forced draft burner, burner control, boiler trim, refractory, insulation, and jacket. Boiler shall be built to withstand a 150 degrees F delta T. The boiler capacity and other requirements shall be as scheduled on the plans. Unit shall conform to ASME SEC4 and SEC8D and AGA Z21.13 and UL726 for construction of boilers and be AGA certified.

Water Tubes: Water tubes are to be steel, multiple pass, flexible serpentine bend design, not subject to thermal shock damage. Individual water tubes shall be easily removable and replaceable without either welding or rolling.

Boiler Shell:

Construct boiler to applicable ASME Boiler and Pressure Vessels Code for allowable working pressure of 30 psig water. Provide two lifting eyes on top of boiler. Provide adequate tappings, observation ports, removable panels and access doors for entry, cleaning, and inspection. Removable access panels to burner and separate removable access panels to water tubes shall each be full width and height designed to provide unobstructed access to burner and water tubes. Insulate casing with 1-1/2 inch minimum thick glass fiber blanket insulation covered by sectional galvanized or zinc coated steel sheet metal jacket. Water tube access panel and chamber shall be insulated with high temperature insulation board permanently attached to panel and casing.

Factory paint boiler, base, and other components with hard finish enamel.

Hot Water Boiler Trim:

Provide Low Water Cut-off with drain valve and manual reset to automatically prevent burner operation whenever boiler water falls below safe level.

Provide complete automatic reset type temperature controls that shall, as a minimum control burner on/off to maintain temperature and control burner firing rate to maintain temperature. A manual reset type temperature control shall also be provided to control the burner to prevent boiler water temperature from exceeding safe system water temperature.

Provide pressure control of fixed setting type to control burner to ensure minimum operating pressure.

Provide ASME rated pressure relief valves, piped to drain.

Provide combination pressure and thermometer gage.

Fuel Burning System:

Provide forced draft automatic burner designed to burn natural gas at 1050 Btuh/cubic foot and 7 inches water gage inlet pressure and maintain fuel-air ratios automatically.

Burner shall be a "LoNOx" burner that meets the requirements of SCAQMD.

Blower shall be statically and dynamically balanced, have adequate capacity to supply combustion air to burner and be directly connected to motor.

Single motor shall control combustion air damper and fuel valves.

Gas burner shall be forced draft, high radiant multiport power burner with electric ignition and modulating main valves with low fire ignition position.

Natural gas burner piping shall be factory installed and shall be complete gas train including high and low gas pressure switches, plug valve, gas pressure regulator, pilot valve and modulating main valve.

Controls:

Mount NEMA 250, Type 1 hinged metal panel on boiler, containing electronic combustion control, blower motor starter, low fire hold time, automatic-manual firing selection switch, and control switches.

Provide electronic combustion control-to-control ignition, starting and stopping of burner, and both pre-combustion purge and post combustion purge. Burner shall shut down in event of ignition, pilot, or main flame failure. Interlock to shut down burner upon combustion air pressure drop.

Provide electronic detector to prevent primary fuel valves from opening until pilot flame is established.

BOILER STACK

Boiler stack and fittings shall be factory fabricated fuel chimney, double wall, air insulated, all metal construction and shall include straight section stack, elbows if required, roof support, flashing, storm collar, and vent cap. Stack and fittings shall be from the same manufacturer.

Inner Pipe: Fabricated of Type 304 stainless steel with nominal 1 inch air space between walls.

Outer Jacket: Aluminum coated steel.

Joints: Stack and vents shall have snap-lock joints or compression band joints that provide tight sealing and rigid joints.

PART 3 - EXECUTION

INSTALLATION

Installation Requirements:

Install as indicated, plumb and level, firmly anchored, in accordance with the respective manufacturer's installation instructions.

Install accessories, appurtenances, piping and controls, including supports, vibration isolators, stands, guides, anchors, clamps, and brackets as indicated.

Locate equipment as indicated, having manufacturers' recommended working space available for servicing. Provide electric isolation between dissimilar metals.

Drain Piping: Route unit drain to nearest floor drain.

Boiler Stack and Gas Vent Installation: Comply with manufacturer's recommendations, Uniform Mechanical Code, and local code requirements. Fasten and support the stack and vent system securely to building structure. Maintain required clearance from combustible materials. Keep offsets and lengths of horizontal pipe to minimum unless indicated otherwise.

Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring-diagram submittal to electrical installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

PAINTING

Boiler shall have manufacturer's standard finish. Equipment shall be touched up with factory-supplied paint applied in accordance with the manufacturer's instructions.

START-UP SERVICE

Provide the services of a factory-authorized service representative to inspect the installation and connections and to provide initial start-up service. Services shall include a complete operational check and demonstration of the system to ensure proper operation.

Provide instructions to the District's maintenance personnel on proper operation and maintenance procedures.

FIELD QUALITY CONTROL

Perform start-up tests of boiler equipment in conformance with "Testing, Adjusting and Balancing" for HVAC in elsewhere in these special provisions.

TRAINING

After complete installation and testing of boiler provide four hours of training for up to eight of the owner's maintenance personnel to adjust, operate, and maintain the boiler. The training shall be performed by a factory authorized representative and include manuals required.

12-15.15 ROTARY-SCREW WATER CHILLER

PART 1 – GENERAL

SUMMARY

Scope: This work consists of the requirements for packaged air-cooled chillers.

DEFINITIONS

BAS: Building automation system.

COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

PERFORMANCE REQUIREMENTS

Seismic Performance: Chiller shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

SUBMITTALS

Product Data: Submit manufacturer's product data indicating total installation instructions, assembly support details, thermal loads, motor horsepower, electrical characteristics, sequence of operation, connection requirement, performance curves, start-up instruction and installation, testing procedure instructions. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

Performance at ARI standard conditions and at conditions indicated.

Performance at ARI standard unloading conditions.

Minimum evaporator flow rate.

Refrigerant capacity of chiller.

Oil capacity of chiller.

Fluid capacity of evaporator.

Characteristics of safety relief valves.

Minimum entering condenser-air temperature.

Maximum entering condenser-air temperature.

Performance at varying capacities with constant-design entering condenser-air temperature. Repeat performance at varying capacities for different entering condenser-air temperatures from design to minimum in 10 deg F increments.

Working Drawings: Include plans, elevations, sections, details, and attachments to other work.

Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.

Wiring Diagrams: For power, signal, and control wiring.

Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Structural supports.

Piping roughing-in requirements.

Wiring roughing-in requirements, including spaces reserved for electrical equipment.

Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

Certificates: For certification required in "Quality Assurance" Article.

Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Operation and Maintenance Data: Include emergency, operation, and maintenance manuals.

QUALITY ASSURANCE

ARI Certification: Certify chiller according to ARI 590 certification program(s).

ARI Rating: Rate chiller performance according to requirements in ARI 550/590.

ASHRAE Compliance:

ASHRAE 15 for safety code for mechanical refrigeration.

ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.

ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.

Comply with NFPA 70.

Comply with requirements of UL and include label by a qualified testing agency showing compliance.

DELIVERY, STORAGE, AND HANDLING

Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.

COORDINATION

Coordinate sizes and locations of concrete bases with actual equipment provided. Cast or drill anchor-bolt inserts into bases.

WARRANTY

Warranty Period: One year from date of Completion.

PART 2 - PRODUCTS

PACKAGED, AIR-COOLED CHILLER

Subject to compliance with requirements, provide product indicated on the plans or comparable product by one of the following or equal:

Carrier Corporation; a United Technologies company.

Trane; a division of American Standard.

YORK International Corporation.

Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.

Fabricate base, frame, and attachment to chiller components strong enough to resist chiller movement during a seismic event when chiller base is anchored to field support structure.

Cabinet:

Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.

Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.

Casing: Galvanized steel.

Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500hour salt-spray test according to ASTM B 117.

Compressors:

Description: Positive displacement, hermetically or semi-hermetically sealed.

Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.

Rotors: Manufacturer's standard one- or two-rotor design.

Each compressor provided with suction and discharge shutoff valves, crankcase oil heater, and suction strainer.

Service: Easily accessible for inspection and service.

Capacity Control: On-off compressor cycling and VFD or modulating slide-valve assembly, or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.

Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.

Operating Range: From 100 to 15 percent of design capacity.

Condenser-Air Unloading Requirements over Operating Range: Constant-design entering condenser-air temperature, Drop-in entering condenser-air temperature of 5 deg F drop for each 10 percent in capacity reduction.

For units equipped with a variable frequency controller, capacity control shall be both "valveless" and "stepless," requiring no slide valve or capacity-control valve(s) to operate at reduced capacity. The variable frequency controller shall be of the clean power type.

Oil Lubrication System: Consisting of pump, if required, filtration, heater, cooler, factory-wired power connection, and controls.

Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.

Thermostatically controlled oil heater properly sized to remove refrigerant from oil.

Factory-installed and pressure-tested piping with isolation valves and accessories.

Oil compatible with refrigerant and chiller components.

Positive visual indication of oil level.

Vibration Control:

Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.

Overspeed Test: 25 percent above design operating speed.

Isolation: Mount individual compressors on vibration isolators.

Compressor Motors:

Hermetically or semi-hermetically sealed and cooled by refrigerant suction gas. High-torque, induction type with inherent thermal-overload protection on each phase.

Compressor Motor Controllers:

Across the Line: NEMA ICS 2, Class A, full voltage, nonreversing.

Star-Delta, Reduced-Voltage Controller: NEMA ICS 2, closed transition.

Variable Frequency Controller:

Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.

Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.

Enclosure: Unit mounted, NEMA 250, Type 3R, with hinged full-front access door with lock and key.

Integral Disconnecting Means: Door-interlocked**,** NEMA AB 1, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000.

Technology: Pulse width modulated (PWM) output suitable for constant or variable torque loads.

Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.

Refrigerant Circuits:

Refrigerant Type: R-134a

Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.

Pressure Relief Device:

Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

Evaporator:

Description: Shell-and-tube design. The water and refrigerant configuration shall be either of the following.

Direct-expansion (DX) type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.

Flooded type with fluid flowing through tubes and refrigerant flowing around tubes within the shell.

Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

Shell Material: Carbon steel.

Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.

Fluid Nozzles: Terminated with flanged end connections for connection to field piping.

Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.

Heater: Factory installed and wired electric heater with integral controls designed to protect the evaporator to 20 deg F.

Air-Cooled Condenser:

Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.

Construct coil casing of galvanized or stainless steel.

Construct coils of copper tubes mechanically bonded to aluminum fins.

Coat coils with a baked-epoxy, corrosion-resistant coating after fabrication.

Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

Fans: Direct-drive corrosion resistant propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.

Fan Motors: Totally enclosed nonventilating (TENV) or totally enclosed air over (TEAO) enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.

Fan Guards: Steel safety guards with corrosion-resistant coating.

Electrical Power:

Factory installed and wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.

House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.

Wiring shall be numbered and color-coded to match wiring diagram.

Install factory wiring outside of an enclosure in a raceway.

Field-power interface shall be to circuit breaker type disconnect switch located inside the chiller control panel.

Disconnect means shall be interlocked with door operation.

Minimum withstand rating shall be as required by electrical power distribution system, but not less than 42,000.

Provide branch power circuit to each motor and to controls with one of the following disconnecting means:

NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.

NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

Provide each motor with overcurrent protection.

Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.

Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.

Provide power factor correction capacitors to correct power factor to equal to or greater than 0.90 at full load.

Control Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

Power unit-mounted controls where indicated.

Power unit-mounted, ground fault interrupt (GFI) duplex receptacle.

Control Relays: Auxiliary and adjustable time-delay relays.

For chiller electrical power supply, indicate the following:

Current and phase to phase for all three phases.

Voltage, phase to phase, and phase to neutral for all three phases.

Three-phase real power (kilowatts).

Three-phase reactive power (kilovolt amperes reactive).

Power factor.

Running log of total power versus time (kilowatt-hours).

Fault log, with time and date of each.

Controls:

Standalone and microprocessor based.

Enclosure: Share enclosure with electrical power devices or provide a separate enclosure for remote mounting in the field.

Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In imperial units, display the following information:

Date and time.

Operating or alarm status.

Operating hours.

Outdoor-air temperature if required for chilled-water reset.

Temperature and pressure of operating set points.

Entering and leaving temperatures of chilled water.

Refrigerant pressures in evaporator and condenser.

Saturation temperature in evaporator and condenser.

No cooling load condition.

Elapsed time meter (compressor run status).

Pump status.

Antirecycling timer status.

Percent of maximum motor amperage.

Current-limit set point.

Number of compressor starts.

Control Functions:
Manual or automatic startup and shutdown time schedule.

Entering and leaving chilled-water temperatures, control set points, and motor load limits.

Current limit and demand limit.

External chiller emergency stop.

Antirecycling timer.

Automatic lead-lag switching.

Variable evaporator flow.

Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

Low evaporator pressure or high condenser pressure.

Low chilled-water temperature.

Refrigerant high pressure.

High or low oil pressure.

High oil temperature.

Loss of chilled-water flow.

Control device failure.

Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.

Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.

BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.

ASHRAE 135 (BACnet) communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

Insulation:

Material: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

Thickness: 3/4 inch; factory-applied insulation over cold surfaces of chiller components.

Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface. Seal seams and joints.

Apply protective coating to exposed surfaces of insulation to protect insulation from weather.

Accessories:

Factory-furnished, chilled-water flow switches for field installation.

Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.

Factory-furnished neoprene isolators for field installation.

Tool Kit: Chiller manufacturer shall assemble a tool kit specially designed for use in serving the chiller(s) furnished. Include special tools required to service chiller components not readily available to Owner service personnel in performing routine maintenance. Place tools in a lockable case with hinged cover. Provide a list of each tool furnished and attach the list to underside of case cover.

Capacities and Characteristics:

Capacity: As scheduled on plans.

Low Ambient Operation: Chiller designed for operation to 20 deg F.

High Ambient Operation: Chiller designed for operation to 110 deg F.

Evaporator:

Configuration: Integral to chiller.

Pressure Rating: 300 psig.

Fluid Type: Water.

Fouling Factor: Consistent with ARI 550/590.

Other Design Conditions: As scheduled on plans.

Number of Refrigerant Circuits: Each compressor on an independent circuit.

Compressor: a minimum of 2 compressors

Chiller Electrical Requirements: as scheduled on plans.

Noise Rating: 101 dBa sound power level when measured according to ARI 370. Provide factory-installed sound treatment if necessary to achieve the performance indicated.

SOURCE QUALITY CONTROL

Perform functional tests of chillers before shipping.

Factory run test each air-cooled chiller with water flowing through evaporator.

Factory performance test air-cooled chillers, before shipping, according to ARI 550/590.

Test the following conditions:

Design conditions indicated.

Reduction in capacity from design to minimum load in steps of with condenser air at design conditions.

At four point(s) of varying part-load performance to be selected by Department at time of test.

Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

Factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 3 - EXECUTION

EXAMINATION

Examine chillers before installation. Reject chillers that are damaged.

Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.

Final chiller locations indicated on the plans are approximate. Determine exact locations before roughing-in for piping and electrical connections.

Proceed with installation only after unsatisfactory conditions have been corrected.

CHILLER INSTALLATION

Install chillers on support structure indicated.

Equipment Mounting: Install chiller on concrete bases. Comply with requirements for concrete bases specified under "Cast-in-Place Concrete" in Section 12-3 "Concrete," of these special provisions.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Maintain manufacturer's recommended clearances for service and maintenance.

Charge chiller with refrigerant and fill with oil if not factory installed.

Install separate devices furnished by manufacturer and not factory installed.

CONNECTIONS

Comply with requirements for piping specified under "Hydronic Piping" in Section 12-15 "Mechanical," of these special provisions. Drawings indicate general arrangement of piping, fittings, and specialties.

Install piping adjacent to chiller to allow service and maintenance.

Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange.

Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

STARTUP SERVICE

Engage a factory-authorized service representative to perform startup service.

Complete installation and startup checks shall be according to manufacturer's written instructions.

Verify that refrigerant charge is sufficient and chiller has been leak tested.

Verify that pumps are installed and functional.

Verify that thermometers and gages are installed.

Operate chiller for run-in period.

Check bearing lubrication and oil levels.

For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.

Verify proper motor rotation.

Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.

Verify and record performance of chiller protection devices.

Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.

Prepare test and inspection startup reports.

DEMONSTRATION

Engage a factory-authorized service representative to train up to 8 State maintenance personnel to adjust, operate, and maintain chiller. Training shall last 4 hours and shall include manuals for all eight personnel.

12-15.16 FANS AND VENTILATORS

PART 1 – GENERAL

SUMMARY

Scope: This work consists of furnishing and installing HVAC and Laboratory facility exhaust systems, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

Related Work:

Temperature controls such as thermostats, relays, timer switches, and other sensor type control devices required for this work shall be furnished and installed by the supplier of the ventilating equipment. All temperature and control wiring shall be furnished and installed in accordance with the requirements specified in Section 12-16, "Electrical," of these special provisions.

Testing, adjusting and balancing of ventilating equipment shall be as specified elsewhere in these special provisions..

Nameplates shall be as specified elsewhere in these special provisions..

SUBMITTALS

Working Drawings: Submit Working Drawings indicating plans, elevations, and sections; dimensions and weights of equipment; electrical connections; wiring diagrams; control diagrams, product data for controls; safety devices; interlocks; platforms and mounting bases.

Product Data: Submit manufacturer's product data and installation instructions for each fan, including fan performance curves, sound power ratings, and electrical characteristics.

Operation and Maintenance Data: Submit manufacturer's operation and maintenanceinstructions. Include parts and special tools lists.

Test Reports: Provide test reports for fume hood fans.

QUALITY ASSURANCE

Fans shall be manufactured at an ISO 9001 certified facility and Underwriter's Laboratories (UL 705) listed.

PART 2 – PRODUCTS

EXHAUST FANS

Coating: All un-galvanized steel fan components shall be treated with an electro-statically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method. Fans used for high temperature oven exhausts shall instead have all steel fan components coated with a heat resistant silicon-alkyd resin.

Wheel: Applicable fans shall have a blower wheel that is steel, non-overloading, centrifugal backward inclined, or airfoil type. Blades on all sizes shall be continuously welded to the backplate and deep spun inlet shroud. Hubs shall be keyed and securely attached to the fan shaft. Wheel shall overlap aerodynamic aluminum inlet cones to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96.

Motor: Motors shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. Variable Frequency Drive (VFD) for the VFD motors are specified under Division 16 of these Special Provisions.

Bearings: Bearings are designed and tested specifically for use in air handling applications. Bearings are heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 400,000 hours for horizontal units, and L50 life in excess of 250,000 hours for vertical units at maximum cataloged operating speed.

Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

Shaft: Fan shafts shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM. For Utility fans shaft shall be Type 316 Stainless Steel accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.

Name Plate: Units shall bear an engraved aluminum nameplate. Nameplate shall indicate design L/s (CFM), static pressure, and maximum fan RPM.

Manufacturer: Fans shall be Cook, Greenheck, or equal.

Exhaust fan (ceiling mounted): Exhaust fan shall be ceiling mounted, AMCA certified and shall be equipped with grille, backdraft damper and metal housing. Exhaust fan motor shall have integral thermal overload protection. Ceiling exhaust fan shall be Greenheck, Cook, or equal.

Exhaust Fan (Roof Mounted Upblast Centrifugal): Fans shall be a spun aluminum, roof mounted, direct driven, upblast extended pressure centrifugal exhaust ventilator. The fans shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. A two piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. The motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream.

PART 3 – EXECUTION

INSTALLATION

Install fan level and plumb, in accordance with manufacturer's installation instructions. Secure fan with galvanized or cadmium-plated hardware. Provide supporting steel, mounting curbs, and anchorage devices as required to properly support the unit.

Install suspended units independently from building structure using threaded steel rods and vibration isolators, unless otherwise indicated.

Make final connections to ductwork using flexible connectors. Secure flexible duct connectors mechanically to fan and duct to provide airtight joints. Install 1/2-inch mesh bird screen on discharge of weather hood downstream from discharge shutter.

Exhaust ducts connected to exhaust fans shall be routed as shown on the plans and shall terminate in a weatherproof storm cap. Duct sizes shall be as shown on the plans or as recommended by the manufacturer, whichever is larger.

START-UP SERVICE

Provide the services of a factory-authorized service representative to inspect the installation and connections and to provide initial start-up service. Services shall include a complete operational check and demonstration of the equipment operation to ensure proper operation.

TRAINING:

Engage a factory-authorized service representative to train up to 8 State maintenance personnel to adjust, operate, and maintain chiller. Training shall last 4 hours and shall include manuals for all eight personnel.

FIELD QUALITY CONTROL

Perform start-up tests of air-handling units for proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM. Replace fan and motor pulleys as required to achieve design conditions. Measure and record motor electrical values for voltage and amperage. Shut unit down and reconnect automatic temperature control operators as applicable. Perform tests in accordance with the respective manufacturer's instructions and applicable codes and standards.

12-15.17 DUST COLLECTION SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work consists of designing, furnishing and installing a dust collection system, complete and ready for use, in accordance with the details shown on the plans and these special provisions.

SUBMITTALS

Working Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections. Submit construction layout and details for inlet fittings.

Product Data:

Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical requirements and wiring diagrams, and location and sizes of field connections.

Submit sound power levels for both fan inlet and outlet at rated capacity.

Submit two additional copies of product data for incorporation into permit applications to the South Coast Air Quality Control District (SCAQMD). These additional copies shall include initial; submittals and subsequent submittals.

Closeout Submittals: Provide Manufacturer's Installation and Maintenance Instruction including instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams

REGULATORY REQUIREMENTS

Equipment shall conform to the rules and regulations of the SCAQMD.

QUALITY ASSURANCE

Fans:

Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

Fabrication: Conform to AMCA 99.

System: System shall conform to the State of California and the South Coast Air Quality Management District Rules and Regulations.

QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

PRODUCTS

Performance: As shown on the plans, based on sea level conditions.

Refer to Fan Schedule. Ratings are based on AMCA 210. Sound ratings are in accordance with AMCA 301.

Wheel and inlet: Backward Inclined, steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

Housing: Heavy gauge steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.

Motors and Drives:

Bearings: Heavy duty pillow block type, self aligning, grease lubricated ball bearings or roller bearings.

Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.

V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed; variable and adjustable pitch for motors 15 hp and under; fixed sheaves for motors 20 hp and over, matched belts, and rated minimum 1.5 times nameplate rating of motor.

Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.

ACCESSORIES

Inlet Vanes: Inlet vanes shall be one of the following as specified on the plans:

Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.

Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism out of air steam terminating in single control lever with control shaft for double width fans and locking quadrant.

Discharge Dampers: Opposed blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.

Inlet/Outlet Screens: Galvanized steel welded grid.

DUCTWORK AND DUCT ACCESSORIES

Materials

Galvanized Steel Ducts: ASTM A 525 or ASTM A 527 galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A 90, minimum 16 gage, riveted and soldered at temperatures below 400 F.

Fabricate and support in accordance with SMACNA Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.

Duct Gauges: 22 for all duct sizes.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees, minimum 18 gage.

Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard, minimum 16 gage. Prime coat welded joints.

Elbows and angles:

1. Centerline radius, 2.0 radius ratio.
2. Larger radii: Heavy concentration of highly abrasive dust.
3. Elbows 6 inches or less diameter: Five sections minimum.
4. Elbows over 6 inches diameter: Seven sections.
5. Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
6. Use double nuts and lock washers on threaded rod supports.
7. Flexible Connectors: UL 214 listed.

Material: Neoprene double coated closely woven glass fabric flexible connections.

Fasten fabric to sheet metal duct work and to fan collar extension or flange with 3/16 inch rivets spaced not more than 5 inches on center.

Locate in inlet and outlet of all fans, as close to fan as possible.

Connections shall not be under tension.

Angle rings: Carbon Steel, unpainted, leg out, drilled with boltholes.

Duct sealer: Duct sealer shall meet the following:

NFPA rating of "Non-Combustible."

Flame spread rating: 25 or lower, in dry condition.

Smoke developed rating: 50 or lower, in dry condition.

Resistant to water and water vapors.

Pressure rupture rating: 16 inch water gauge, minimum.

Acceptable Manufacturers: Durkee-Atwood, Permatite Class I; Hardcast 601.

FILTER SEPARATOR

Indoor dust collector consisting of structural frame and casing, filters, fan and accessories.

Frame and Casing: Steel frame with enamel finish, 16 gauge galvanized steel panels, 55 gallons dust storage capacity bin.

Filter: Cotton fabric filters, 8 ounces/sq yd density, 244 square feet filter area, 99.5 percent dust spot efficiency.

Fan: Welded construction centrifugal fan with material handling wheel, direct drive with capacity as shown on the plans.

Accessories: Manual shaker, Differential static pressure gage Discharge silencer and Push Button control panel with motor starter.

EXECUTION

INSTALLATION

Install equipment in accordance with manufacturers instructions and NFPA 91.

Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

Install fans with resilient mountings and flexible electrical leads.

Install flexible connections at separator inlet. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

Provide access openings or cleanouts every 10 ft, near each elbow, angle or duct junction in horizontal sections.

Ductwork: Air-tight, tight-fitting, well fabricated.

CLEANING

At completion of work and prior to final acceptance, clean all work installed under this section.

EQUIPMENT DEMONSTRATION

Prior to final acceptance, inspect and test, in presence of State, operation of each piece of equipment and its accessories installed under this section.

If inspection or test shows defects, repair or replace defective work and repeat inspection and tests until defects are eliminated.

DEMONSTRATION AND PERSONNEL INSTRUCTION

Engage a factory-authorized service representative to train up to four State maintenance personnel to adjust, operate, and maintain the dust collection system. Training shall last 4 hours and shall include four manuals.

12-15.18 BUILDING CONTROL SYSTEM

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing all labor, materials, and equipment necessary for a complete and operating Building Control System (BCS), utilizing Direct Digital Controls (DDC).

Related Sections:

1. Basic materials shall be installed as specified in “Pipe, Valves and Fittings” in Section 12-15, "Mechanical" of the Special Provisions.

2. Basic electrical materials shall be as specified in "Basic Materials And Methods" in Section 12-16, "Electrical" of the Special Provisions.

DEFINITIONS

Zone: A zone is the area served by one fan coil unit.

RH: Relative Humidity.

PID: Proportional, Integral, Derivative (Control).

SYSTEM DESCRIPTION

The BCS shall provide HVAC interaction and dynamic process manipulation, including overall building system supervision, coordination and control. This shall include HVAC control, metering, energy management, alarm monitoring, and all trending, reporting and maintenance management functions related to normal building operations all as indicated on the drawings or elsewhere in this specification. BCS shall include workstation, software, and firmware for operational control as well as valves, actuators, sensors and other appurtenances necessary for control of the building HVAC systems.

General Requirements:

1. Provide and install a dedicated, stand-alone automatic Direct Digital Control system complete with all required software and hardware. This system will directly control all specified mechanical equipment. The DDC shall perform control algorithms, calculations and all monitoring functions.

2. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate.

3. Zones shall be controlled by direct digital logic control for space temperature, scheduling, optimum starting, equipment alarm reporting, and override timers for after-hours usage.

4. The workstation shall be a personal computer (PC). The workstation shall allow a user to interface with the network via graphic and/or text format.

5. Complete energy management firmware, including self adjusting optimum start, power demand limiting, global control strategies and logging routines for use with total control systems shall be installed on the Workstation. All energy management firmware shall be resident in field hardware and not dependent on the Workstation for operation.

6. HVAC Equipment Electrical Ladder Diagrams: Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

7. Component Wiring Diagrams: Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

8. Terminal Strip Diagrams: Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

9. BACnet Communication Architecture Schematic: Provide a schematic showing the DDC system's entire BACnet communication network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices.

SUBMITTALS

Product Data: Manufacturer's product data shall be submitted for all manufactured materials and equipment. Submit control and wiring diagrams, control sequences, bus riser diagrams, and valve and damper schedules that shall include rough-in dimensions, component layout and wire number identification.

Working Drawings: Submit working drawings for Direct Digital Control System containing the following information:

1. Schematic flow diagram of system showing chiller, boiler, fans, pumps, fan coils, dampers, valves, and control devices.

2. Label each control device with setting or adjustable range of control.

3. Location of each input and output device

4. Wiring diagrams indicating all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

5. Logic diagrams showing sequence of events and their relationship.

6. Details of faces of control panels, including controls, instruments, and labeling.

7. Include sequence of operation.

8. Written sequence of operation for the HVAC equipment

9. Include the following in the project's control system drawing set:

a. Control system drawings title sheet
b. List of I/O Points
c. Control System Components List
d. Control system schematics
e. HVAC Equipment Electrical Ladder diagrams
f. Component wiring diagrams
g. Terminal strip diagrams
h. BACnet communication architecture schematic

Operation and Maintenance Manuals:

1. Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in both bound manual form and CD ROM and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

2. Manuals shall be submitted for the following equipment:

a. DDC Controllers
b. All sensors
c. All thermostats
d. All valves with actuators
e. Workstation
f. Operating system
g. Firmware
h. All dampers with actuators

QUALITY ASSURANCE

The controls contractor shall assume complete responsibility for the entire controls system as a single source. He shall certify that he has on staff under his direct employ on a daily basis, factory trained technical personnel. These employees shall be qualified to project manage, engineer, commission, and service all portions of the control system.

The installer shall be certified for installation by the Building Control Systems Manufacturerof the control system. The installer shall present certification upon request. The installer shall have a minimum of five years documented experience in Building Control Systems installations.

All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 2 years

Verification of Dimensions: The contractor shall verify all dimensions in the field, and advise the Engineer of any discrepancy before performing work.

Contractor's Qualifications: Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years.

Modification of References: The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Engineer.

DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Engineer. Replace damaged or defective items.

SITE CONDITIONS

Operating Environment: Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the limits prescribed by the manufacturer.

PART 2 – PRODUCTS

DIRECT DIGITAL CONTROL (DDC):

1. The DDC shall be a solid-state sixteen-bit micro-controller with pre-tested and factory configured software specifically designed for regulating building equipment. The DDC shall include inherent input/output capability. Each controller shall include a minimum of eight inputs and eight outputs. The DDC's input/output capability shall include a combination of standard HVAC sensor input and output types. The DDC shall support discrete and either 0–10 VDC and 4–20 ma type analog outputs. The DDC shall support the following sensor input types as a minimum:

Dry contact and pulsing dry contacts
0 to 10-Volt DC and 4–20 mA analog inputs
5K and 10K thermistors
1000 ohm Nickel RTD

2. If the DDC's input/output capability is exceeded, additional controllers with inherent input/output capability shall be provided, or the Contractor may supply a DDC capable of supporting additional DDC-I/O modules.

3. LED's shall indicate communication status for the primary communications bus and Local Interface Device (LID). The separate LED's shall flash whenever communications are occurring. The DDC shall communicate to all connected points at least once a second.

4. All output channels shall include diagnostic LED's. Whenever a discrete output has been enabled by the DDC, an LED associated with that channel shall light. When used with analog output points the LED will indicate the commanded position by dimming and brightening of the LED when the H-O-A is in the Auto position. When the output is commanded to its minimum position the LED will become dim. As the analog output commanded position increases, the brightness of the LED will increase, until it is fully illuminated at the maximum commanded output.

5. Each input and output channel shall include a configuration switch such that the user shall be able to select the input or output type from any of the types listed above. The DDC and DDC-I/O shall utilize "plug type" terminals such that the user may be able to disconnect and replace a module simply by removing the plug type connectors and plugging them into a new module.

6. The DDC shall be capable of supporting HAND-OFF-AUTO (H-O-A) override switches for all output channels. The H-O-A switches shall be accessible to the user and shall allow the user the ability to force the controllers discrete outputs on, off, or in an automatic mode allowing the DDC to command the discrete output channel on and off. When used with analog output channels, the hand position will command the analog output to its maximum value. When the switch is indexed to the automatic mode the DDC's algorithm will command the output.

DDC Controller Attributes

DDC controllers shall be mounted in a standard NEMA 1 type enclosure. Class II, 24-volt transformers shall power the controller. The controller shall be listed under UL: 916-PAZX (Energy Management).

DDC controllers shall include a 365-day real-time clock and watchdog timer diagnostic indicator provided by an LED. The watchdog timer shall reset upon power on and be resettable by software thereafter. Should the watchdog timer not be resettable during the timing period, it shall time out and set all outputs to their non-powered state. The LED shall illuminate solidly to indicate this failure.

All configuration data, custom programs, etc., shall be stored in non-volatile memory. The controller shall provide a minimum of two days data retention for the time clock and consumable data (runtimes, GPM, and other data).

DDC controllers shall include the capability to provide a local interface for all operating values, alarms, etc., via a hand held, panel mounted, or remotely mounted Local Interface Device. DDC controllers shall also be capable of interfacing to a portable PC for configuring or altering the configuration, setting the address, performing uploads/downloads, entering of custom programs, through a separate, additional RJ14 plug.

DDC controllers shall be capable of operating in either a stand-alone mode or as part of a network with a workstation and other system elements including Product Integrated Controllers (PIC).

DDC Controller Software

Software shall have priority password security systems to prevent unauthorized use. Each user shall have an individual password, or users can be assigned to a group password. Each user shall be assigned which control functions they have access to. Equipment monitoring and alarm function including information for diagnosing equipment problems and alarm dial out to remote sites or pagers shall be included.

The complete system, including, but not limited to zone controllers, field installed DDC controllers and operator's terminals, shall auto-restart, without operator intervention, on resumption of power after a power failure.

All software and/or firmware shall interface equipment for connection to remote monitoring station from field hardware or the operator's terminal. Communication wiring for field controllers shall not be run in star patterns.

The system shall be capable of recording equipment runtime totalization of fans, heaters, boilers, and also capable of alarm generation and alarm dial out to remote sites.

All DDC hardware and software shall be designed and manufactured by U.S. corporations. All hardware shall be Listed Underwriters Laboratory for Open Energy Management Equipment (PAZX) under the U.L. standard: 916, with integral labels showing rating.

DDC controllers shall provide stand-alone operation and shall accept analog and discrete signals from sensors, switches, relays, etc., and shall multiplex the various signals into digital format. All closed loop Direct Digital Control routines shall utilize controller based software algorithms that shall be resident in its memory. All standard and custom control controller based algorithms shall operate independently, and systems that require an on-line host computer or intermediary processor to control mechanical or electrical equipment are not acceptable.

Time Schedules:

1. Each time schedule shall include provisions for eight individual-day types (Monday through Sunday and holidays), and each individual-day type shall contain at least seven individual on-off time periods. DDC controllers shall support one-minute granularity. Systems that use a granularity of greater than one minute shall not be accepted.

Set point Schedules:

1. Each Set point schedule shall be individually definable in terms of:

   a. Engineering Units
   b. Occupied High Set point
   c. Occupied Low Set point
   d. Unoccupied High Set point
   e. Unoccupied Low Set point

Controller software shall include the capability to link specific time schedules with corresponding Set point schedules for any particular DDC loop.

Remote Timed Override:

1. DDC controllers shall support remote timed override through the use of a space sensor with an integral override button or a momentary contact switch. Whenever the override is initiated during the unoccupied period and the controller is configured to provide remote override the time schedule associated with the override shall become occupied for 0-1-2-3-4 hours (operator selectable). Whenever the time schedule becomes occupied the controller shall control its associated control points to their occupied Set point.

2. DDC controllers shall provide a power-fail restart routine that shall provide an adjustable staggered time delay for each DO point selected, to avoid sudden power peaks.

Input/Output Signal Processing

Input Processing:

1. Each connected or calculated input point shall be independently processed to provide accurate data values. The controller shall perform all point processing. All connected and calculated points, both analog and discrete, shall be individually configured and be capable of displaying their values at the LID, portable PC or at a connected workstation. Input points may be added, deleted or modified via the Local Interface Device, portable PC, and if tied into a network, by the workstation. Discrete input points shall be monitored for status, alarm or consumable data.

2. Analog inputs shall be monitored to provide feedback to a control loop, to annunciate that an analog alarm limit has been exceeded, to offer centralized analog monitoring or to monitor consumable data. Discrete and analog inputs shall be able to interact with controller resident algorithms for local processing.

3. The operator shall be able to create sensor groups for use in the algorithms. The sensor groups will provide the lowest, highest, or average values, as applicable to the application and algorithm.

4. Controller software shall include a trim function to allow for the field calibration of analog input sensors.

Alarm Processing: DDC controllers shall contain a routine to process alarms and alerts. Alarm processing shall be initiated once per second and shall consist of a scan of all input points. Alarm processing logic shall also monitor return to normal conditions as part of the alarm scan. The operator will have the ability to modify the alarm/alert priority level.

Output Processing:

1. Discrete Outputs:

2. Discrete outputs shall be used to command two state devices (on/off, open/close). Each discrete output point must be capable of being individually configured by the operator.

3. The following types of DDC routines shall be provided for discrete outputs as a minimum:

a. Enthalpy/Analog Comparison.
b. Analog.
c. Interlock.
d. Time Clock/Cycling.
e. Time Clock/Cycling with Temperature Override.
f. Staged Thermostat (Minimum of four stages plus fan).
g. Staging Control.
h. Lead/Lag Pump Control with Automatic Fault Logic.
i. Staging algorithms will include adjustable on/off delays as well as adjustable differential between stages.

4. Analog Outputs:

a. Analog outputs shall be used to command modulating/variable position devices. Each analog output must be capable of individual configuration via the operator.
b. As a minimum, the following preprogrammed analog out algorithms shall be resident at the controller:

Cooling Coil Control
Heating Coil Control
Mixed Air Damper Control
Sequenced Cooling and Heating Coil Control
Static Pressure and Fan Tracking Control
Adaptable Control

c. The algorithms shall support both dual (master/submaster) and single control loops, and shall include PID control, as required.

Overrides And Interlocks

The DDC shall have the capability to manually override a controller's input or output value and input a different value in its place. Manual overrides shall be capable of being initiated via the LID, portable PC or the workstation, if part of a network. All manually initiated overrides shall be manually removed.

DDC controllers shall also be capable of providing event initiated overrides of normal control algorithms. Specific preprogrammed interlock sequence programming shall be configured via the Local Interface Device, portable PC or the workstation, if part of a network.

Stand-Alone Data Collection

Traces: DDC controllers shall include the inherent ability to perform automatic point tracing based on a change in value of a discrete or analog point. The trace function shall be operator selectable to store up to 60 samples at an operator-configured interval. When the point trace is full the operator shall be able to have the trace stop, wrap around, or to stop and trigger another trace of the point to begin. The trace values shall be displayed at the LID, portable PC or workstation, if part of a network.

Runtimes/Consumables:

1. Any discrete input may be linked by the operator to a runtime table for the purposes of displaying equipment runtime totals. Equipment runtime alarms shall also be displayed at the LID.

2. Any discrete or analog input shall be capable of being used to calculate and display consumable data such as GPM.

FACILITY MANAGEMENT APPLICATION SOFTWARE:

DDC controllers shall contain the following preprogrammed application software:

1. Night Time Free Cooling (NTFC)
2. Adaptive Optimal Start/Stop
3. Power Fail Restart

CUSTOM PROGRAMMING:

Provide a controller based, interactive, programming language for the purpose of creating custom programs for specific, unique applications. Complex control strategies shall be able to be developed by the State.

All custom programming must be performed in English language and shall be addressable by user specific English names without requiring alphanumeric addresses or point numbers. Programming languages such as BASIC or FORTRAN shall not be acceptable for these applications, and the custom programs shall be retained in controller memory and shall not require a host CPU to operate correctly. Custom programs shall be capable of supporting customary US units. All custom programming point data shall be capable of being transferred from one controller to another (if networked) directly without an on-line CPU or host computer.

Networking

DDC controllers shall include the inherent ability to be networked with other system elements to allow a dynamic exchange and sharing of information without the addition of communication cards or additional software. Systems that require a host computer to be in the system architecture or on-line will not be allowed.

This information exchange shall include but not be limited to the following:

1. Broadcast of time, date, holiday, outside air temperature and relative humidity.

2. Data Collection of consumable and runtime data in addition to stand-alone controller based consumable and runtime data.

3. Data transfer to receive and utilize input/output point data from and to other system elements.

4. Water System Manager (To allow a dynamic exchange of information between the fan coil load and the water source)

5. Chiller Plant Manager

6. DataPort/DataLINK (ASCII conversion) and alarm printer interface

7. BAClink (BACnet)

8. Custom Programming

HARDWARE:

Workstation: Workstation shall consist of a computer, monitor, 102 standard USB keyboard, optical mouse, printer and UPS. Workstation shall be industry-standard server hardware that shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified in Performance Standards Section. Hard drive shall be internal, SATA-300, 500 GB, 7200 rpm, 16 MB buffer, or have sufficient memory to store system software, one year of data for trended points specified in Point List, and a system database at least twice the size of the existing database at system acceptance if larger than 500 GB. Workstation shall be IBM-compatible PCs with a minimum of:

1. High-end Dual Core or Core 2 processor.

2. High-end Server Class motherboard.

3. Tower case with 450 Watt power supply and multiple exhaust fans.

4. 4 GB RAM, maximum 2 stick.

5. DVD+/-RW SATA combo internal drive.

6. PCI Express x16, 512 MB DDR2 graphics card.

7. Monitor shall be 19" LCD monitor, 4:3 aspect ratio, 1280x 1024 resolution, maximum 6 ms response time and related cords.

8. UPS shall be rated for 120-Volt input, 120-Volt output, with 3 outlets and rated for 750 watts.

9. Printer shall be laser printer, 20 ppm, 1200 DPI, 16 MB RAM, minimum 500 sheet input capacity, network, USB and Ethernet connectibility.

All insulated wire shall be MTW stranded copper conductors, size and number of strands as specified by the Controller manufacturer.
The Communications Bus shall be a three-conductor cable with shield. The communications bus shall comply with FCC Part 15, Subpart J, Class B for bus radiated and conductive noise.

Communications Bus shall be capable of having multiple system elements connected. Each Communications Bus shall allow for the use of modules as an interface to secondary Buses. Whenever the Communications Bus enters or leaves a building, the Bus shall be provided with adequate lightning suppression devices.

The Communications Bus shall be capable of communicating through a telephone modem to a remote building. This interface shall allow any workstation, as applicable, to communicate with any other remotely located, compatible, communications bus.

The communications infrastructure shall be capable of supporting a two-tiered physical architecture consisting of a manufacture specified layer and Ethernet Layer. All controllers and system interface devices shall maintain peer-to-peer flat, logical, communications architecture from either physical layer. The infrastructure shall rely on the use of communications routers that will encapsulate messages on the manufacture specified layer and pass them to or through the Ethernet layer. These routers shall provide a seamless, transparent connection from the manufacture specified layers or segments to an Ethernet backbone, network, as well as to computers with a direct Ethernet connection. The Ethernet routers shall have full communication capability with the DDC network without loss of dynamic data or functional control tables.

Ethernet Router:

1. The manufacture specified communications segments shall have the capability to be connected using a minimum of 200 Ethernet routers in order to extend the manufacture specified communications segments over the Ethernet. The Ethernet routers shall support flexible Internet Protocol addressing. The Ethernet routers shall support either static or Dynamic Host IP address assignments. Addressing shall be capable of being done in more than one way. A standard Windows tool such as HyperTerminal shall allow a non-HVAC technician to commission the Ethernet router. The Ethernet router shall also be able to be fully commissioned using a standard commissioning tool that an HVAC technician is familiar with.

2. The Ethernet router shall have the following minimum components and capabilities:

32 Bit Micro Processor
10 Base-T/100 Base-Tx MDIX Ports
RS232 Console Port
RS485 Network Port
Status and Communication LED's

OPERATING SYSTEM:

Operating system software shall be a current version of Microsoft Windows, Professional/Business Version, at time of installation. Operating system shall be configured as follows:

1. Priority password security systems to prevent unauthorized use. Each user shall have an individual password, or users can be assigned to a group password. Each user shall be assigned which functions they have access to.

2. Navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. These links may be arranged in a hierarchical fashion, such as navigating from the home screen to a particular building, then to a specific floor in the building, and then to a specific room or piece of equipment.

FIELD SENSORS AND RELATED HARDWARE:

Space Temperature Sensors: Space Temperature Sensors shall be 5,000 or 10,000-ohm thermistors with wall plate adapter and blank cover assembly. The sensor shall include an integral occupancy override button, and shall also include a RJ11 communications port. Temperature Sensors shall include space temperature adjustment slides where shown on the plans. The space Temperature Sensors shall be mounted to meet ADA requirements.

Duct Temperature Sensors**:** Duct Temperature Sensors shall be 1000 ohm averaging RTD's, or 10,000 ohm averaging thermistors. Single point sensors shall be 5,000 ohm or 10,000 ohm thermistors.
Outside Air Sensor**:** Sensor shall be 5,000 or 10,000 ohm thermistor, with integral housing or NEMA 4 box and ½" NPT conduit connector.

Water Temperature Sensors: Water Temperature Sensors shall be well mounted 5,000 or 10,000 ohm thermistors, or 1,000 ohm RTD's. Install extended neck wells where applicable on insulated pipes.

Flow Sensors**:** Flow Sensors shall be complete with safety shut-off valves and all necessary connections. Flow sensors shall generate a 4-20 mA proportional signal.

Space Relative Humidity Sensor: Space Relative Humidity Sensors shall have a range of 0-100% RH and be provided with wall plate adapter and blank cover. The sensors shall be electronic type. The measuring accuracy shall be 3% over the range of the device. Space RH sensors shall be mounted 60" above the floor.

Space CO2 Sensor with Temperature Sensor**:** The wall mounted combination sensors shall contain a space temperature sensor and Carbon Dioxide (CO2) sensor in a single housing. The CO2 sensor shall use single-beam absorption infrared diffusion technology, and shall have integral programming to perform automatic baseline calibration without user interface. The recommended manual recalibration period shall not be less than five years. The CO2 range shall be 0-2000 PPM with analog outputs of 4-20 ma or 0-10 v. the power source shall be 18 to 30-Volt AC, 60 Hz. The accuracy shall be +/- 100 PPM at 60 degrees F to 90 degrees F. The sensor shall include an integral occupancy override button, a set point adjustment potentiometer, and a communication port.

Status Indication**:** Status indication for fans and pumps shall be a current sensing device. The device shall consist of a current transformer, solid-state current sensing circuit with adjustable trip point, and a solid state or contact switch. A red LED mounted on the box shall indicate the ON OFF status of the unit. The switch shall provide a solid state or N.O. contact for wiring back to the DDC.

Filter-Status Switch**:** Filter Switch shall be a differential pressure type, adjustable across the range of the device, with a single pole double throw switch. The range shall be 0.05" to 2" water column.

Differential Pressure Switch**:** Differential pressure Switch shall be a differential pressure type, adjustable across the range of the device, with a single pole double throw switch. The range shall be 0.05" to 2" water column.

Changeover Thermostats: Changeover thermostats shall be 10,000-ohm strap on thermistors with flexible copper plate and screw clamp for externally mounting on the pipe.

Start/Stop and Status Relays**:** Start/Stop and Status Relays shall be designed to plug into a screw terminal-mounting socket. Relays shall be single pole, or double pole as required with double throw contacts rated for required duty.

DAMPERS, ACTUATORS, AND VALVES:

Mixed Air Dampers:

1. Mixed air dampers shall be multiple blade parallel or opposed blade type as listed. All fixed dampers shall be installed with manual linkage controls. All other dampers shall be installed with electronic actuators.

2. Modulating outdoor air and return dampers shall be opposed blade type with blade and side seals.

3. Damper frames shall be 16 gauge galvanized steel channel or 1/8" extruded aluminum with reinforced corner bracing. Damper blades shall not exceed 8" in width or 48" in length. Blades shall not be less than 16 gauge. Damper shaft bearings shall be as recommended by manufacturer for the application. All blade edges and top and bottom of the frames shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 10-cfm/sq. ft at 2" w.c. differential pressure. Dampers shall have exposed linkages.

Electronic Actuators:

1. Electronic actuators shall be UL listed under standard 873. Electronic actuators shall be designed to directly couple and mount to a stem, shaft or ISO style-mounting pad. Actuator mounting clamps shall be a V-bolt with a toothed V-clamp creating a cold weld, positive grip effect. Single point, bolt, or single screw actuator type fastening techniques or direct-coupled actuators requiring field assembly of the universal clamp shall not be allowed.

2. Actuators shall be fully modulating/proportional, pulse width, floating/tri-state, or two position as shown on the plans and be factory or field selectable. Actuators shall have visual position indicators and shall operate in sequence with other devices if required. Proportional actuators shall accept a 0-10 VDC or 0-20 mA input signal and provide a 2-10 VDC or 4-20 mA (with a load resistor) operating range. Actuators shall have an operating range of –22° to 122°F.

3. Actuators shall be 24-volt with Class 2 wiring. Power consumption shall not exceed 50 VA for AC.

4. Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation. Damper and valve actuators will not produce more than 62 dB when furnished with a mechanical fail-safe spring. Non-spring return actuators shall conform to a maximum noise rating of 45 dB(A) with power on or in the running or driving mode.

5. Where shown on the plans for power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Spring return actuators shall be capable of CW or CCW mounting orientation. Spring return models greater than 60 in-lbs. will be capable of mounting on shafts up to 1.05" in diameter. Spring return actuators with more than 60 in-lb. of torque shall have a metal, manual override crank.

6. Upon loss of control signal, a proportional actuator shall fail open or closed based on the minimum control signal. Upon loss of power, a non-spring return actuator shall maintain the last position.

7. Dual mounted actuators using additional anti-rotation strap mechanical linkages, or special factory wiring to function shall not be allowed.

Control Valve:

1. A Teflon, flow-characterizing disc shall be installed in the inlet of 2-way characterized control valves and in the control port of 3-way valves. The valve trim shall utilize a stainless steel ball and stem. For water applications, an optional chrome plated brass ball and brass stem can be used.

2. Valve bodies shall be nickel-plated, forged brass with female NPT threads. Bodies to 1-1/4" shall be rated at 600 psi and sizes 1-1/2" to 2" at 400 psi. The maximum allowable pressure differential shall be 150 psi for on/off and 50 psi for modulating service.

3. Control Valves shall have a self-aligning, blowout proof, brass stem with a dual EPDM O-ring packing design. Fiberglass reinforced Teflon seats shall be used.

The valves shall have a four bolt mounting flange to provide a 4 position, field changeable, electronic actuator mounting arrangement.

4. A non-metallic coupling, constructed of high temperature, continual use material shall provide a direct, mechanical connection between the valve body and actuator. The coupling shall be designed to provide thermal isolation and eliminate lateral and rotational stem forces. Vent hole shall be provided to reduce condensation build-up.

Globe Valve:

1. Screwed globe valves 1/2" through 2" shall have bronze bodies rated at ANSI Class 250. All stems shall be stainless steel. Trim shall include a brass plug, a spring-loaded TFE packing, and a bronze seat. The maximum differential shall be 35 psi for water.

2. 2-way and 3-way flanged globe valves 2-1/2" to 6" shall have cast iron bodies rated for ANSI Class 125. The maximum differential shall be 25 psi for water. Trim shall include stainless steel stems, bronze plugs, bronze seats, and TFE V-ring packing.

Butterfly Valve:

1. Butterfly valves shall be a fully lugged, drilled and tapped, cast iron body with actuator. Flanges shall meet ANSI: 125/150 standards. The one-piece body shall feature an extended neck allowing sufficient clearance for flanges and 2" of piping insulation. The disc shall be aluminum bronze and provide bi-directional bubble-tight close off in either direction. The disc shall be polished and contoured to minimize torque and wear. Two-inch to six-inch valves shall be rated for a maximum of 200-psi close off and eight-inch to twelve-inch shall be rated a maximum of 75-psi close off.

2. The disc shall have full 360-degree concentric seating and connected to a stainless steel shaft. A non-collapsing, EPDM seat shall be field replaceable and shall create a positive seal between flange face and valve body. No gaskets shall be required between the valve and flange faces. The shaft shall be supported at three locations by PTFE bushings.

3. The valve actuator shall consist of a high torque reversible electric motor, gear train, limit switches and terminal block; all contained in a die cast aluminum NEMA 4 enclosure with NPT output. Output shaft shall be nickel plated to prevent corrosion. Actuator shall be suitable for operation in ambient temperature ranging from -22°F to +150°F.

4. The motor shall be fractional horsepower; permanent split capacitor type, continuous duty, 120-Volt, 1 pH, 60 Hz supply. A self-resetting thermal switch shall be imbedded in the motor for overload protection. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel.

5. 2 SPDT auxiliary switches, rated at 250-Volt shall be included. Actuator shall be equipped with a hand wheel for manual override. Hand wheel must be permanently attached to the actuator. When in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven. Actuator shall have heater and thermostat to minimize condensation within the actuator housing. Modulating units shall include programmable card capable of 0-10 V(DC), 2-10 V(DC), 4-20 mA, and 1-5 VDC default settings.

SOURCE TESTING

The manufacturer prior to shipment shall individually test all controllers, sensors, and DDC components and ship test results.

PART 3 – EXECUTION

INSTALLATION

The installation shall be performed under the supervision of competent technicians regularly employed in the installation of DDC systems.

Status Indication**:** Status indication for all fans indicated on the plans and pumps shall be installed at each motor starter or motor to provide load indication.

Electronic actuators shall be installed on all valves used for zone control, including all Control and Globe valves,

Zone valves with brass bodies shall be used in terminal unit water applications where sizing or physical limitations prohibit the use of characterized control valves, or in terminal equipment, where water sizing dictates a 2 or 3-way electronic control valve 3/4” or smaller.

Control Valves shall be used for all water applications where sizing permits.

2-way and 3-way globe valves may be used only if characterized control valves do not fit the sizing criteria or application.

Butterfly valves may be used in all two-position applications, in modulating applications larger than 2-1/2”, or where the close off rating of other valve styles does not meet the design requirements.

Outside air Sensor shall not be located in direct sunlight, or where influenced by exhaust air.

The flow measuring sensor shall be installed above a safety shut-off valve. The valve shall be installed onto a tee of the pipe being measured.

Hand-Off-Auto Switches: Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

Temperature Sensors: Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

Room Temperature Sensors: Mount the sensors on interior walls to sense the average room temperature at the locations indicated.

Duct Temperature Sensors: Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration airtight. Seal the duct insulation penetration vapor tight.

TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel as specified under "HVAC Testing/Adjusting/Balancing" in Section 12-15 "Mechanical," of the Special Provisions. This support shall include:

1. On-site operation and manipulation of control systems during the testing and balancing.

2. Control set point adjustments for balancing all relevant mechanical systems.

3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

FIELD QUALITY CONTROL

Tools and Calibration Equipment: The Building Control System supplier shall provide all tools and calibration equipment necessary to ensure reliability and accuracy of the control system.

Performance Verification Testing (PVT), General: The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor in the presence of the Engineer. If the project is phased, provide separate testing for each phase. Conduct a Pre-PVT meeting with the Engineer to review the Pre-PVT checklist and coordinate all aspects of the PVT testing. Submit a detailed PVT Plan of the proposed testing. Develop the PVT Plan specifically for the control system of the contract.

1. List test items in a logical sequence including the intended test procedure, expected response, pass/fail criteria, and a separate column for field comments.

2. The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments.

3. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, and the Engineer to acknowledge successful completion.

PVT Sample Size: Test all central plant equipment and fan coil unit controllers unless otherwise directed. Twenty-five percent sample testing is allowed for identical controllers typical of fan coil units. The Department may require testing of like controllers outside of a statistical sample if sample controllers require retesting or do not have consistent results. The Department may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Department may choose which ones.

Pre-PVT Checklist: Prior to conducting the PVT, thoroughly inspect the installed work with the Contractor's QA representative and the mechanical contractor using the following checklist. Submit the checklist with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

1. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

2. Verify HVAC motors operate below full-load amperage ratings.

3. Verify all required control system components, wiring, and accessories are installed.

4. Verify the installed control system architecture matches approved drawings.

5. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

6. Verify all required surge protection is installed and functions correctly.

7. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.

8. Verify all DDC network communications function properly, including uploading and downloading programming changes.

9. Using the BACnet protocol analyzer, verify communications are error free.

10. Verify each digital controller's programming is backed up.

11. Verify all wiring, components, and panels are properly labeled.

12. Verify all required points are programmed into devices.

13. Verify all TAB work affecting controls is complete.

14. Verify all valve and actuator zero and span adjustments are set properly.

15. Verify all sensor readings are accurate and calibrated.

16. Verify each control valve and actuator goes to normal position upon loss of power.

17. Verify all control loops are tuned for smooth and stable operation

18. Verify each controller works properly in stand-alone mode.

19. Verify all safety controls and devices function properly, including interfaces with building fire alarm systems.

20. Verify all electrical interlocks work properly.

21. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook. Notify the Department when phone lines or network connections are needed at least 60 days prior to installation of the workstation.

22. Verify the as-built (shop) control drawings are completed.

Conducting Performance Verification Testing:

1. Conduct the PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Engineer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

2. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.

3. If re-testing is required, follow the procedures for the initial PVT. The Department may require re-testing of any control system components affected by the original failed test.

4. Test the following for each controller:

a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.

b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.

c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.

d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.

e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

5. Workstation and Software Operation

a. Show proper workstation and notebook setup and operation.

b. Show that points lists agree with naming conventions.

c. Show that graphics are complete
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d. Show that the UPS operates as specified.

6. BACnet Communications and Interoperability Areas: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.

b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.

c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters via BACnet messages and write services initiated by an operator using workstation graphics.

d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.

e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).

f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.

g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any local workstation by an operator with sufficient privilege.

h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.

i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.

j. Device and Network Management: Show the following capabilities -

(1) Display of Device Status Information
(2) Display of BACnet Object Information
(3) Silencing Devices that are Transmitting Erroneous Data
(4) Time Synchronization
(5) Remote Device Reinitialization
(6) Backup and Restore Device Programming and Master Database(s)
(7) Configuration Management of Half-Routers, Routers and BBMDs

7. Execution of Sequence of Operation: Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internet.

Control Loop Stability and Accuracy: For all control loops tested, give the Department trend graphs of the control variable over time, demonstrating that the control loop responds to a 20% sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20% set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

Performance Verification Testing Report: Upon successful completion of the PVT, submit a PVT Report. Do not submit report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets requirements of the contract.

DEMONSTRATION

Training Requirements:

1. Provide a capable and qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed.

2. Coordinate training times with the Engineer after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Department-furnished location.

3. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

Training Documentation: Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopses of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

Curriculum:

Phase I Training – Fundamentals:

General: The Phase I training session shall last [one day] [two consecutive days] and be conducted in a classroom environment with complete audio-visual aids provided by the contractor. Provide each trainee a printed 8.5 x 11 inch hard-copy of all visual aids used.

Objectives: Upon completion of the Phase I Training, each trainee should fully understand the project's DDC system fundamentals. The training session shall include the following:

a. BACnet fundamentals (objects, services, addressing) and how/where they are used on this project

b. This project's list of control system components

c. This project's list of points and objects

d. This project's device and network communication architecture

e. This project's sequences of control, and:

f. Alarm capabilities

g. Trending capabilities

h. Troubleshooting communication errors

i. Troubleshooting hardware errors

Phase II Training - Operation

General: Provide Phase II Training shortly after completing Phase I Training. The Phase II training session shall last [one day] [two consecutive days] and be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary.

Objectives: Upon completion of the Phase II Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

a. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)

b. A discussion of the components and functions at each DDC panel

c. Logging-in and navigating at each operator interface type

d. Using each operator interface to find, read, and write to specific controllers and objects

e. Modifying and downloading control program changes

f. Modifying setpoints

g. Creating, editing, and viewing trends

h. Creating, editing, and viewing alarms

i. Creating, editing, and viewing operating schedules and schedule objects

j. Backing-up and restoring programming and data bases

k. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics

l. Creating new graphics and adding new dynamic data displays and links

m. Alarm and Event management

n. Adding and removing network devices

12-15.19 TESTING, ADJUSTING AND BALANCING OF HVAC

PART 1 – GENERAL

SUMMARY

Scope: This guide specification covers the requirements for the testing, adjusting, and balancing of all heating, ventilating and air conditioning systems.

Related Work:

Requirements for HVAC are specified under "Heating Ventilation and Air Conditioning Equipment and Systems" in Section 12-15 "Mechanical," of these special provisions.

Requirements for chiller equipment are specified under "Rotary-Screw Water Chillers" in Section 12-15 "Mechanical," of these special provisions.

SUBMITTALS

Preliminary Report: Examine the installed systems and submit a written preliminary report to Engineer indicating any deficiencies in the systems that could preclude the proper adjusting, balancing, and testing of the systems. Resolve deficiencies as required.

Agenda: The Contractor shall submit an agenda for approval by the Engineer prior to start of testing and balancing work. The agenda shall include the following information:

1. General description of each HVAC system with its associated equipment and operation cycles for heating, intermediate, and cooling. Where different cycles are used for day and night, they shall be described separately.

2. A complete listing of all airflow and air terminal measurements to be performed.

3. Proposed selection points for sound measurements.

4. Specific test procedures and parameters for determining specified quantities (e.g., flow, drafts, sound levels) from the actual field measurements to establish compliance with contract requirements.

5. Samples of report forms with blank spaces for all data specified herein. These forms shall demonstrate applications of procedures and calculations to typical systems.

Test Procedures: Specific test procedures for measuring air quantities at terminals shall be submitted to specify type of instrument to be used, method of instrument application (by sketch), and factors for the following conditions:

1. Air terminal configuration;

2. Flow direction, supply or exhaust;

3. Velocity corrections;

4. Effective area applicable to each size and type of air terminal; and

5. Density corrections unless applicable data are covered elsewhere.

Sample Forms: Submit sample forms, if forms other than those prepared by the AABC or NEBB are proposed.

Instrument Calibration: Submit certified documentation showing test instrument calibration data and date.

Test Reports: Submit certified test reports for each system, including information as specified.

Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

QUALITY ASSURANCE

Perform testing, adjusting, and balancing, using the services of an independent testing and balancing agency regularly engaged in the testing and balancing of air and water systems and associated equipment and piping systems. The agency selected shall be a certified member of the Associated Air Balance Council (AABC). The agency shall be independent of the installing personnel or equipment supplier for this project.

Work shall be performed in accordance with the agenda specified herein. Procedures and methods specified herein shall be followed and, if not specifically specified herein, shall be performed in accordance with the AABC MN-1; NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems; SMACNA HVAC Systems Testing, Adjusting and Balancing; ASHRAE Handbook, HVAC Applications; and ASHRAE Handbook, HVAC Systems and Equipment.

Provide test results and final reports certified and signed by a professional mechanical engineer currently registered in the State of California.

Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a pre-balancing conference with the Engineer, and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

Test, adjust, and balance the air systems before testing, adjusting, and balancing of the hydronic, steam, and refrigerant systems, as applicable.

PROJECT CONDITIONS

Pre-Balancing Requirements:

Prior to testing or starting, clean inside of each piece of equipment and provide clean filters.

Prior to any startup, obtain Engineer's approval of test procedures for airflow testing, adjusting, and balancing.

System Operation:

Testing and balancing shall not begin until each system has been completed and is in full working order. Put all heating, ventilating, and air-conditioning systems and equipment, including controls, into full operation and continue the operation of the systems during each working day of testing and balancing.

Tests shall be performed and adjustments made as necessary to accomplish the design objectives.

In systems with two or more operating modes, the system operation in the primary mode shall be tested, balanced, and adjusted. After final adjustment in the primary mode, the secondary modes shall be tested, and the system data recorded. The Engineer will determine whether additional balancing and adjusting are necessary to meet the requirements.

In systems with redundant equipment, each piece of equipment shall be tested and adjusted independently to operate within the design criteria.

Readjustments: Should corrective measures caused by faulty installation require retesting, adjusting, and balancing, such work shall be performed at no additional cost to the Department.

PART 2 - PRODUCTS

PRE-TEST

Examine strainers for clean screens and proper perforations.

Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

Examine heat-transfer coils for correct piping connections and for clean and straight fins.

Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

Examine equipment for installation and for properly operating safety interlocks and controls.

Examine automatic temperature system components to verify the following:

Dampers, valves, and other controlled devices operate by the intended controller.

Dampers and valves are in the position indicated by the controller.

Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers variable-air-volume terminals.

Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing valves, are properly connected.

Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.

Sensors are located to sense only the intended conditions.

Sequence of operation for control modes is according to the Contract Documents.

Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.

Interlocked systems are operating.

CONSTANT-VOLUME AIR SYSTEMS

Measure fan static pressures to determine actual static pressure as follows:

Measure static pressure across each air-handling unit component.

Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures- Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

Adjust fan speed higher or lower than design with the approval of the Engineer. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan motor amperage to ensure no overload will occur Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to design airflows within specified tolerances.

Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.

VARIABLE-AIR-VOLUME SYSTEMS
Similar to constant air system with following additions:

Compensating for Diversity: When the total airflow of all terminal units is more than the fan design airflow volume, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the design airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

Set outside air dampers at minimum, and return and exhaust air dampers at a position that simulates full-cooling load.

Select the terminal unit that is most critical to the supply-fan airflow and static pressure for the critical terminal unit is not less than the sum of the terminal unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge duct losses.

Measures total system airflow. Adjust to within 10 percent of design airflow.

Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use the terminal unit manufacturers written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

Record the final fan performance data.

Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

Balance systems similar to constant-volume air systems.

Set terminal units and supply fan at full-airflow condition.

Adjust inlet dampers of each terminal unit to design airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

Readjust fan airflow for final maximum readings.

Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.

Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that the controller is maintaining it.

Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

Set system at maximum design airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

Adjust supply fan to maximum design airflow with the variable-airflow controller set at maximum airflow.

Set terminal units being tested at full-airflow condition.

Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to design airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

Adjust terminal units for minimum airflow.

Measure static pressure at the sensor.

Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

HYDRONIC SYSTEMS

Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

Prepare schematic diagrams of systems' "as-built" piping layouts.

Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

Open all manual valves for maximum flow.

Check expansion tank liquid level.

Check makeup-water-station pressure gage for adequate pressure for highest vent.

Check flow-control valves for specified sequence of operation and set at design flow.

Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.

Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

Check air vents for a forceful liquid flow exiting from vents when manually operated.

HYDRONIC SYSTEMS' BALANCING

Determine water flow at pumps. Use the following procedures:

Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump.

Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

Report flow rates that are not within plus or minus 5 percent of design.

Measure flow at all stations and adjust, where necessary, to obtain first balance.

Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.\par

Adjust balancing stations to within specified tolerances of design flow rate as follows:

Determine the balancing station with the highest percentage over design flow.

Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.

Record settings and mark balancing devices.

Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

Measure the differential-pressure control valve settings existing at the conclusions of balancing.

VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

MOTORS

Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.

2. Motor horsepower rating.

3. Motor rpm.

4. Efficiency rating if high-efficiency motor.

5. Nameplate and measured voltage each phase.

6. Nameplate and measured amperage each phase.

7. Starter thermal-protection-element rating.

Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

BOILERS

Measure entering- and leaving-water temperatures and water flow.

CHILLERS

Chillers Measure and record the following:

a. Water flow rate in gpm (LUs).
b. Water pressure differential in feet of head or psig (kPa).
c. Entering-water temperature in deg F (deg C).
d. Leaving-water temperature in deg F (deg C).
e. Condenser entering-water temperature in deg F (deg C).
f. Condenser leaving-water temperature in deg F (deg C).

g. Condenser water temperature differential in deg F (deg C).
h. Condenser entering-water pressure in feet of head or psig (kPa).
i. Condenser leaving-water pressure in feet of head or psig (kPa).
j. Condenser water pressure differential in feet of head or psig (kPa).
k.Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig (kPa).
n. High-pressure-cutout set point in psig (kPa).
o. Suction pressure in psig (kPa).
p. Suction temperature in deg F (deg C).
q. Condenser refrigerant pressure in psig (kPa).
r. Condenser refrigerant temperature in deg F (deg C).
s. Oil pressure in psig (kPa).
t. Oil temperature in deg F (deg C).
s. Voltage at each connection.
u. Amperage for each phase.
v. The kW input.

REHEAT COILS

Measure the following data for each coil:

1. Entering- and leaving-water temperatures.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperatures of entering and leaving air.
5. Wet-bulb temperatures of entering and leaving air for cooling coils designed for less than 7500 cfm (3540 Us).
6. Airflow.
7. Air pressure drop.

PART 3 - EXECUTION

FINAL REPORT

General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

Final Report Contents: In addition to the certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance.
5. Summary of contents, including the following:

    a. Design versus final performance.
    b. Description of system operation sequence if it varies from the Contract Documents.
    c. Nomenclature sheets for each item of equipment.
    d. Data for terminal units, including manufacturer, type size, and fittings.
    e. Notes to explain why certain final data in the body of reports vary from design values.

Test conditions for fans and pump performance forms, including the following:

1. Settings for outside-, return-, and exhaust-air dampers.
2. Conditions of filters.
3. Cooling coil, wet- and dry-bulb conditions.
4. Face and bypass damper settings at coils.
5. Other system operating conditions that affects performance.

System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present. with single-line diagrams and include the following:

1. Water flow rates.
2. Pipe and valve sizes and locations.
3. Terminal units.
4. Balancing stations.

Air-Conditioning Unit Test Reports for fan-coil units include the following:

1. Unit identification.
2. Location.
3. Make and type.
4. Model number and unit size.
5. Manufacturer's serial number.
6. Unit arrangement and class.
7. Sheave make, size in inches (mm), and bore.
8. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
9. Number of belts, make, and size.
10. Number of filters, type, and size.

Motor Data: Include the following:

1. Make and frame type and size.
2. Horsepower and rpm.
3. Volts, phase, and hertz.
4. Full-load amperage and service factor.
5. Sheave make, size in inches (mm), and bore.
6. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

Test Data: Include design and actual values for the following:

1. Total airflow rate in cfm (L/s).
2. Total system static pressure in inches wg (Pa).
3. Fan rpm.
4. Discharge static pressure in inches wg (Pa).
5. Filter static-pressure differential in inches wg (Pa).

Air-Terminal-Device Reports: For terminal units, include the following:

1. System and air-handling unit identification.
2. Location and zone.
3. Test apparatus used.
4. Area served.
5. Air-terminal-device makes.
6. Air-terminal-device number from system diagram.
7. Air-terminal-device type and model number.
8. Air-terminal-device size.
9. Air-terminal-device effective area in sq. ft. (sq. m).

System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. System and air-handling unit identification.
2. Location and zone.
3. Room or riser served.
4. Coil make and size.
5. Flowmeter type.

Test Data: Include design and actual values for the following:

1. Airflow rate in cfm (L/s).
2. Entering-water temperature in deg F (deg C).
3. Leaving-water temperature in deg F (deg C).
4. Water pressure drop in feet of head or psig (kPa).
5. Entering-air temperature in deg F (deg C).
6. Leaving-air temperature in deg F (deg C).

FIELD SERVICES

Instruction of Department's Personnel: The Testing and Balancing Agency shall instruct the Department's personnel in the proper operation, setting, and adjustment of the equipment.

Re-inspection: The Testing and Balancing Agency shall make two return inspection trips to the project, one during a period when actual conditions match heating design conditions and one during a period when actual conditions match air-conditioning design conditions, for the purpose of checking out the entire system (or group of systems). The Testing and Balancing Agency shall make additional adjustments as required during the re-inspection.

SECTION 12-16 ELECTRICAL

12-16.01 ELECTRICAL WORK

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of performing electrical work in accordance with the details shown on the plans and these special provisions. Section 86, "Signal, Lighting and Electrical Systems," of the Standard Specifications shall apply when specific reference is made hereto.

Electrical work shall include furnishing all labor, materials, equipment and services required to construct and install the complete electrical system shown on the plans and the work of installing electrical connections for the thermostats, motors, and controls specified elsewhere in these special provisions.

System layouts are generally diagrammatic and location of equipment is approximate. Exact routing of conduits and other facilities and location of equipment is to be governed by structural conditions and other obstructions, and shall be coordinated with the work of other trades. Equipment requiring maintenance and inspection shall be located where it is readily accessible for the performance of such maintenance and inspection.

Related Work: Earthwork, foundations, sheet metal, painting, mechanical and such other work incidental to and necessary for the proper installation and operation of the electrical work shall be done in accordance with the requirements specified for similar work elsewhere in these special provisions.

CLOSEOUT SUBMITTALS

Operation and Maintenance Manuals:

Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with parts lists for the equipment specified herein shall be delivered to the Engineer at the jobsite. The instructions and parts lists shall be in a bound manual form and shall be complete and adequate for the equipment installed. Inadequate or incomplete material will be returned. The Contractor shall resubmit adequate and complete manuals at no expense to the State.

Manuals shall be submitted for the following equipment:

Standby Generator
Intrusion Alarm Control Panel
Fire Alarm Control Panel
Photocontroller of the Daylight Control System

QUALITY ASSURANCE

Codes and Standards: All work performed and materials installed shall be in accordance with the CEC and the California Code of Regulations, Title 8, Chapter 4, "Electrical Safety Orders."

Warranties and Guarantees: Manufacturer's warranties and guarantees for materials or equipment used in the work shall be delivered to the Engineer at the jobsite prior to acceptance of the contract.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

TESTING

After the electrical system installation work has been completed, the electrical system shall be tested in the presence of the Engineer to demonstrate that the electrical system functions properly. The Contractor shall make necessary repairs, replacements, adjustments and retests at his expense.

12-16.02 SHORT-CIRCUIT/COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing short circuit and protective device coordination studies as prepared by the equipment manufacturer and an arc flash hazard analysis study per NFPA 70E –Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

SUBMITTALS

Submittals for review and approval: The short-circuit and protective coordination shall be submitted to the design engineer prior to receiving final approval of the distribution equipment working drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittals of sufficient study data to ensure that the selection of device and characteristic will be satisfactory.

Submittals for construction: The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more that five (5) bound copies of the complete final report shall be submitted. The report shall include the following sections:

1. One-line diagram
2. Descriptions, purpose, basis and scope of study
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit studies.
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings
5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
6. Incident energy and flash protection boundary calculations
7. Recommendations for system improvements, where needed
8. Executive summary.

QUALITY ASSURANCE

Qualifications: The short-circuit protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

PART 2 - PRODUCTS

Studies: Contractor to furnish short-circuit and protective coordination studies as prepared by equipment manufacturer. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D..

Data Collection: Contractor shall furnish all data as required by the power system studies. The Electrical Engineer performing the short-circuit and arc flash hazard analysis studies shall furnish the contractor with a listing of required data immediately after the award of the contract. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment working drawings and/or prior to the release of the equipment for manufacturing. Source combination may include present and future motors and generators. Load data utilized may include existing and proposed loads obtained from the contract plans. Include fault contribution of existing motors in the study, with motors less than 100 hp grouped together. The contractor shall obtain required existing equipment data if necessary to satisfy the study requirements.

Short-circuit and protective device evaluation study: The Electrical Engineer shall use actual conductor impedances if known. If unknown, use typical conductor impedances base on IEEE Standards 141-1993. Transformer design impedances shall be used when test impedances are not available. Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions and recommendations.

Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

1. Electric utility’s supply termination point
2. Incoming switchgear
3. Unit substation primary and secondary terminals
4. Low voltage switchgears
5. Standby generators and automatic transfer switches
6. Branch circuit panelboards
7. Other significant location throughout the system
8. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted short-circuit study

Protective device evaluation study: Provide the following:

1. Evaluate equipment and protective devices and compare short circuit ratings.
2. Adequacy of switchgear and panelboard bus bars to withstand short-circuit stresses
3. Adequacy of transformers windings to withstand short-circuit stresses
4. Cable and busway sizes to withstand short-circuit heating
5. Notify owner in writing of existing circuit protective devices improperly rated for the calculated available fault current.

Arc Flash Hazard Analysis: The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposals. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution (switchboards, panelboards and busways) where work could be performed on energized parts. The Arc-flash Hazard analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal or greater than 125 kVA. The Arc flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions. Arc flash computation shall include both line and load side of main breaker calculations, where necessary. Arch Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 Section B1.2. Incident energy and flash protection boundary calculations shall include the following:

1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard risk category
8. Recommendations for arc flash energy reduction.

Portable Computer and Software: Contractor shall furnish to the Engineer a portable lap top computer with the engineering programming software used for the short circuit and protective coordination study and an arc flash hazard analysis study for the project. Software shall be capable of studying at least 300 buses. The lap top computer shall meet or exceed the following requirements:

1. Intel core 2 duo Processor at 2.33 GHz.
2. 4 MB L2 Cache.
3. 667 MHz front side bus.
4. 2 GB DDR2-667 SDRAM.
5. 120 GB HDD.
6. 16x DVD+/-RW Drive with double layer write capability and DVD software.
7. 15.4 WUXGA LCD Color display.
8. Internal 56 Kbps FAX/Modem.
9. Integrated 10/100 Ethernet adapter.
10. Internal Wireless (802.11 b/g, 54 Mbps) .
11. Anti-virus program.
12. Microsoft Windows Vista Business Professional.
13. Microsoft Office Small Business Edition.
14. Adobe Acrobat Standard Retail version – write and read PDF files.
15. PLC programming software/Tool kit.
16. Any necessary software for programming and communication with the supplied PLC.
17. Power supply, 9-Cell battery, 9-Cell spare battery and necessary cables and connectors.
18. Leather classic carrying case.
19. 3-year next business day on site service warranty.

PART 3 - EXECUTION

Field adjustment: Adjust protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Acceptance and Testing contract portion. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies. Notify the Engineer in writing of any required major equipment modifications.. Following completion of studies, acceptance testing and the startup by the field engineering service distribution of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

Arc flash Warning Labels: Labels shall be 3.5 inch X 5 inch thermal transfer type labels of high adhesion polyester for each work station analyzed. Labels shall be machine printed with no field markings. The label shall have an orange header with wording, “WARNING ARC FLASH HAZARD” and shall include the following information:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number and issue date.

TRAINING

The Contractor shall provide a minimum of 4 hours training to at least 5 designated State employees regarding the potential of arc flash hazards associated with working on energized equipment for a minimum of 4 hours. Maintenance procedures in accordance with the requirements of NFPA 70E, Standard For Electrical Safety in the Workplace, shall be provided in the equipment manuals. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

12-16.03 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing conduits, conductors, fittings, and wiring devices in accordance with the details shown on the plans and these special provisions.

Conduits, conductors, fittings, and wiring devices shall include those accessories and appurtenances, not mentioned, that are required for the proper installation and operation of the electrical system.

Related Work:

Roof penetrations shall be flashed and sealed watertight conforming to the requirements specified under "Sheet Metal Flashing" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

Where conduits pass through fire rated walls, floor or ceiling assemblies, the penetrations shall be protected in accordance with the requirements specified under "Through-Penetration Firestopping" in Section 12-7, "Thermal and Moisture Protection," of these special provisions.

SUBMITTALS

Product Data:

A list of materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval. Any other data as requested by the Engineer shall also be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions for recessed junction and pull boxes, and component layout shall be included where applicable. All control and power conductors on the working drawings shall be identified with wire numbers.

PART 2 - PRODUCTS

CONDUITS AND FITTINGS

Rigid Steel Conduit and Fittings:

Rigid steel conduit shall be threaded, full weight rigid steel, hot-dip galvanized inside and outside with steel or malleable iron fittings. Fittings shall be threaded unless otherwise specified or shown on the plans.

Split or three-piece couplings shall be electroplated, malleable cast iron couplings.

Insulated grounding bushings shall be threaded malleable cast iron body with plastic insulated throat and steel, lay-in ground lug with compression screw.

Insulated metallic bushings shall be threaded malleable cast iron body with plastic insulated throat.

Electrical Metallic Tubing (EMT) and Fittings:

Electrical metallic tubing shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam with zinc coating outside and enamel or lacquer coating inside.

Couplings shall be electroplated, rain and concrete tight, gland compression type, steel body couplings with malleable iron nuts.

Connectors shall be electroplated, rain and concrete tight, gland compression type, steel body connectors with male hub, malleable iron nut and insulated plastic throat.

Flexible Metallic Conduit and Fittings:

Flexible metallic conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design.

Fittings shall be electroplated screw-in type with malleable cast iron body and threaded male hub with insulated throat.

Liquid Tight Flexible Metallic Conduit and Fittings:

Liquid tight flexible metallic conduit shall be fabricated in continuous length from galvanized sheet steel, spirally wound and formed to provide an interlocking design with an extruded polyvinyl chloride cover.

Fittings shall be electroplated, malleable cast iron body, with cap nut, grounding ferrule, and connector body with insulated throat.

Rigid Non-metallic Conduit and Fittings:

Rigid non-metallic conduit shall be Schedule 40, high impact, nonconducting, self-extinguishing polyvinyl chloride (PVC) rigid non-metallic conduit for direct underground burial.

Couplings shall be PVC, socket type or thread on one end and socket type on the other end as required for the particular application.

Terminal adapters for adapting PVC conduit to boxes, threaded fittings, or metallic conduit system shall be PVC adapters with threads on one end and socket type on the other end.

CONDUCTORS

Conductors:

Conductors shall be stranded copper wire.

Conductor insulation types unless otherwise shown or specified, shall be as follows:

1. Conductors in control panel enclosures shall be 19-strand Type MTW.
2. Conductors shall be type XHHW-2 in wet, underground, and outdoor locations.
3. Conductors shall be type THHN in all otherlocations.

Wire Connections and Devices: Wire connections and devices shall be pressure or compression type, except that connectors for No. 10 AWG and smaller conductors in dry locations may be preinsulated spring-pressure type.

ELECTRICAL BOXES

Outlet, Device and Junction Boxes:

Unless otherwise shown or specified, boxes shall be galvanized steel boxes with knock-outs and shall be the size and configuration best suited to the application indicated on the plans. Minimum size of outlet, receptacle, switch or junction boxes shall be 4 inches square by 1½ inches deep, except that switch boxes for the installation of single switches and outlet boxes for flush-mounted light fixtures shall be 2" x 3" x 1½" deep.

Multiple switches shall be installed in standard gang boxes, unless otherwise specified or shown on the plans.

Cast metal boxes shall be cast iron boxes with threaded hubs and shall be of the size and configuration best suited to the application shown on the plans.

Flush-mounted boxes shall have stainless steel covers, 0.04 inch thick. Cover screws shall be metal with finish to match cover finish.

Unless otherwise shown or specified, surface-mounted boxes shall have galvanized steel covers with metal screws.

Weatherproof junction boxes shall have cast metal covers with gaskets.

Weatherproof switch and receptacle boxes shall have gasketed covers with gasketed hinged flaps to cover switches and receptacles.

Underground Pull Boxes:

Pull boxes shall conform to the requirements of ES-8 of the Standard Plans and Section 86-2.06, "Pull boxes," of the Standard Specifications.

Traffic rated pull boxes shall conform to the requirements of ES-8 of the Standard Plans and Section 86-2.06, "Pull boxes" of the Standard Specifications.

RECEPTACLES AND SWITCHES

Ground Fault Circuit Interrupter Receptacles, (GFCI): Ground fault circuit interrupter receptacles shall be NEMA Type 5-20R, feed-through type, ivory color, 3-wire, 20-ampere, 125-volt AC, grounding type, specification grade, duplex receptacle with ground fault interruption. Receptacle shall detect and trip at current leakage of 5 milliamperes and shall have front mounted test and reset buttons.

Duplex Receptacles: Duplex receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, specification grade receptacle suitable for wiring with stranded conductors. Unless otherwise noted, receptacles fed from normal power shall be ivory in color and receptacle fed from the standby generator shall be red in color.

Fourplex Receptacles: Fourplex receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, grounding type, single, specification grade receptacle suitable for wiring with stranded conductors.

Single Receptacles: Single receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, safety grounding, ivory color, specification grade receptacle suitable for wiring with stranded conductors.

Single Special Purpose Receptacles (240 volt): Single special purpose receptacles (240 volt) shall be NEMA Type 6-20R, 3-wire, 20-ampere, 250-volt AC, safety grounding, specification grade receptacle suitable for wiring with stranded conductors.

Management Information System (MIS) Receptacles: Management information system (MIS) receptacles shall be NEMA Type 5-20R, 3-wire, 20-ampere, 125-volt AC, isolated grounding, orange color, specification grade receptacle suitable for wiring with stranded conductors.

Despatch LDB oven receptacle outlet: Despatch LDB oven receptacle outlet shall be NEMA Type 5-30R, 3-wire, 30-ampere, 125-volt AC, safety grounding, industrial specification grade receptacle. A mating plug for the receptacle shall be provided.

NCAT furnace receptacle outlet: NCAT furnace receptacle outlet shall be NEMA Type 6-30R, 3-wire, 30-ampere, 250-volt AC, safety grounding, industrial specification grade receptacle. A mating plug for the receptacle shall be provided.

Thermolyne 47500 oven receptacle outlet: Thermolyne 47500 oven receptacle outlet shall be NEMA Type 5-30R, 3-wire, 30-ampere, 125-volt AC, safety grounding, industrial specification grade receptacle. A mating plug for the receptacle shall be provided.

Range receptacle outlet: Range receptacle outlet shall be NEMA Type 6-50, 2-pole, 3-wire, 50-ampere, 250-volt AC, safety grounding, industrial specification grade receptacle. A mating plug for the receptacle shall be provided.

Multi-outlet Assemblies: Multi-outlet assemblies shall be a two-piece steel surface raceway and shall include receptacles and communication outlets spaced 12 inches on center. Raceway shall be a two piece design with a metal base and snap-on on metal covers. Base shall be a minimum of 0.050 inch wall thickness and cover shall be a minimum of 0.040 inch wall thickness. Assembled base shall be 4.750 inches wide by 1.750 inches high with a cross section area of 7.50 square inches. The assembly shall be provided with the necessary entrance end fitting and blank end fitting. Assembly shall include a snap-in divider separating the power conductors and communication cables. Dimensions and type of receptacles and communication outlets in the multi-outlet assemblies shall be as shown on the plans.

Welding Receptacles: Welding receptacles shall be surface-mounted, 600-volt, 60-ampere, 2-wire, 3-pole, circuit breaking, weather resistant, raintight receptacle with female interior assembly. The receptacle shall be complete with back box, angle adapter and spring door. The receptacle shall be grounded through extra pole and shell, and shall have crimp or solder type connections. A mating plug for the receptacle shall be provided.

Snap Switches: Snap switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Three-way Toggle Switches: Three-way toggle switches shall be 20-ampere, 120/277-volt AC, quiet type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Four-way Toggle Switches: Four-way switches shall be 20-ampere, 120/277-volt AC, quite type, specification grade, ivory color switch with silver cadmium alloy contacts. Switch shall be suitable for wiring with stranded conductors.

Timer Switches Single Pole: Timer switches-single pole (spring wound) shall be 20-ampere, 120-volt AC, double pole-single throw, spring wound mechanical timer switches that requires no electricity to operate. Switch shall have a 30-minute range without a “hold” position.

Timer Switches Double Pole: Timer switches-double pole (spring wound) shall be 2 HP rated at 240-volt AC, double pole-single throw, spring wound mechanical timer switches that requires no electricity to operate. All double pole timer switches shall have a one-hour range without a “hold” position except for the exhaust fan EF3.3 which shall have a 15-minute range without a “hold” position

Fan wall timer: Fan wall timer in Long Term Storage shall be 20-ampere, 120-volt AC, electronic timer. Timer shall be capable of 6 ON and 6 OFF operations that can be used for 24 hours or 7 day load control. Timer shall have the ability to program events for a specific time and day of the week or a specific time everyday, a specific time on weekdays or a specific time on weekdays. Timer shall have a factory supplied AA alkaline battery that will provide up to 3 years of programmed protection and time keeping without AC power. A low battery indicator shall be displayed when the battery requires replacement. In addition, the display shall continuously show time of day, day of week timer load and load status.

MISCELLANEOUS MATERIALS

Warning Tape: Warning tape shall be 4-inch wide and contain the printed warning "CAUTION ELECTRICAL CONDUIT" in bold ¾-inch black letters at 30-inch intervals on bright orange or yellow background. The printed warning shall be non-erasable when submerged under water and resistant to insects, acids, alkali, and other corrosive elements in the soil. The tape shall have a tensile strength of not less than 155 pounds per 4-inch wide strip and shall have a minimum elongation of 700 percent before breaking.

Pull Ropes: Pull ropes shall be nylon or polypropylene with a minimum tensile strength of 500 pound-force.

Watertight Conduit Plugs: Watertight conduit plugs shall be hollow or solid stem expansion plugs complete with inner and outer white polypropylene compression plates and red thermoplastic rubber seal. Seal material shall be non-stick type rubber resistant to oils, salt, and alkaline substances normally available at the construction sites.

Anchorage Devices: Anchorage devices shall be corrosion resistant, toggle bolts, wood screws, bolts, machine screws, studs, expansion shields, and expansion anchors and inserts.

Electrical Supporting Devices:

Electrical supporting devices shall be one hole conduit clamps with clamp backs, hot-dipped galvanized, malleable cast iron.

Construction channel shall be 1 5/8 inches by 1 5/8 inches, 12-gage galvanized steel channel with 17/32-inch diameter bolt holes, 1½ inches on center in the base of the channel.

Ground rods shall be ¾-inch (minimum) galvanized or copper clad steel rod, 10 feet long.

Telephone Outlet Boxes:

Telephone outlet boxes shall be 4-inch square boxes and plates with modular type telephone outlet. Boxes on stud walls shall have plaster ring.

Plates for flush mounting outlets in finished room shall be Type 430 stainless steel, 0.04 inch thick with satin finish.

PART 3 - EXECUTION

INSTALLATION

Conduit:

General: Rigid steel conduit shall be used unless otherwise shown on the plans or specified in these special provisions.

Electrical metallic tubing may be used in both furred spaces and for exposed work indoors above the switch height.

Flexible metal conduit shall be used to connect suspended lighting fixtures, motors, HVAC equipment, and other equipment subject to vibration in dry locations.

Liquid-tight flexible metal conduit shall be used to connect motors, HVAC equipment, and other equipment subject to vibration in wet locations.

Rigid non-metallic conduit shall be used for direct underground burial at the locations shown on the plans. All risers and elbows through building floors shall be PVC coated rigid steel conduit.

Conduit Installation:

Conduit trade sizes are shown on the plans. No deviation from the conduit size shown on the plans will be permitted without written permission from the Engineer.

Conduit shall be concealed unless otherwise shown on the plans.

Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.

Rigid non-metallic conduit bends of 30 degrees or greater shall be factory-made long radius sweeps. Bends less than 30 degrees shall be made using an approved heat box.

A pull rope shall be installed in all empty conduits. At least 3 feet of pull rope shall be doubled back into the conduit at each termination.

Locations of conduit runs shall be planned in advance of the installation and coordinated with the ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

Where practical, conduits shall be installed in groups in parallel, vertical or horizontal runs and at elevations that avoid unnecessary offsets.

Exposed conduit shall be installed parallel and at right angles to the building lines.

Conduits shall not be placed closer than 12 inches from a parallel hot water or steam pipe or 3 inches from such lines crossing perpendicular to the runs.

All raceway systems shall be secured to the building structures using specified fasteners, clamps and hangers.

All metal conduits, metal conduit risers, and metal conduit elbows in contact with soil or concrete shall be wrapped with a double layer of 20-mil thick pipe wrapping tape

Single conduit runs shall be supported by using one hole pipe clamps. Where run horizontally on walls in damp or wet locations, conduit shall be installed with "clamp backs" to space conduit off the surface.

Multiple conduit runs shall be supported with construction channel secured to the building structure. Conduits shall be fastened to construction channel with channel compatible pipe clamps.

Raceways of different types shall be joined using approved couplings or transition fittings.

Expansion couplings shall be installed where conduit crosses a building separation or expansion joint.

All floor and wall penetrations shall be sealed water-tight.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air.

Conduit Terminations:

Rigid steel conduits shall be securely fastened to cabinets, boxes and gutters using 2 locknuts and specified insulating metallic bushing. Electrical metallic tubing shall be securely fastened to cabinets, boxes and gutters using specified connectors. Conduit terminations at exposed weatherproof enclosures and cast outlet boxes shall be made watertight using specified hubs.

Grounding bushings with bonding jumpers shall be installed on all type of conduits terminating at concentric knockouts and on all conduits containing service conductors, grounding electrode conductor, and conductors feeding separate buildings.

Rigid non-metallic conduits shall be terminated inside the underground pull boxes with an approved conduit bushings or fittings. All conduits shall enter the pull box at an angle of 45 degrees or more.

All future conduits terminated in underground pull boxes or exposed indoor and outdoor shall be provided with watertight conduit plugs.

Warning Tape: Warning tape shall be placed over each conduit in a trench. Each warning tape shall be centered over the conduit and shall be placed over the 6 inches layer of sand covering the conduit as described elsewhere in these special provisions.

Conductor Installation:

Conductors shall not be installed in conduit until all work of any nature that may cause injury is completed. Care shall be taken in pulling conductors that insulation is not damaged. An approved non-petroleum base and insulating type pulling compound shall be used as needed.

Splices and joints shall be insulated with insulation equivalent to that of the conductor.

Provide 6 inches of slack at each outlet and device connection. If the outlet or device is not at the end of a run of wire, connection shall be made with correctly colored pigtails tapped to the runs with splices as specified herein.

Branch circuit conductors in panelboards and load centers shall be neatly trained along a path from the breaker terminals to their exit point. The conductors shall have ample length to transverse the path without strain, but shall not be so long as to require coiling, doubling back, or cramming. The path shall transverse the panelboard gutter spaces without entering a gutter containing service conductors and, unless otherwise shown on the plans, without entering the gutter space of any panelboard feeder.

All pressure type connectors and lugs shall be retightened after the initial set.

Splices in underground pull boxes and similar locations shall be made watertight.

Junction boxes in furred or accessible ceiling spaces shall be identified with felt-tip pen denoting the circuits contained in the box.

Conductor Identification:

The neutral and equipment grounding conductors shall be identified as follows:

Neutral conductor shall have a white or natural gray insulation except that conductors No. 4 and larger may be identified by distinctive white marker such as paint or white tape at each termination.

Equipment grounding conductor shall be bare or insulated. If insulated, equipment grounding conductors shall have green or green with one or more yellow stripes insulation over its entire length except that conductors No. 4 and larger may be permanently identified by distinctive green markers such as paint or green tape over its entire exposed insulation.

Ungrounded feeder and branch circuit conductors shall be color coded by continuously colored insulation, except conductors No. 6 AWG or larger may be color coded by colored tape at each connection and where accessible. Ungrounded conductor color coding shall be as follows:

SYSTEM	COLOR CODE
120/240V-Single phase	Black, blue
120/240V-Three phase	Black, orange, blue
120/208V-Three phase	Black, red, blue
277/480V-Three phase	Brown, orange, yellow

Once an insulated circuit conductor, including grounded and ungrounded conductors, is identified with a specific color code, that color code shall be used for the entire length of the circuit.

Where more than one branch circuit enters or leaves a conduit, panel, gutter, or junction box, each conductor shall be identified by its panelboard and circuit number. All control conductors including control conductors of manufacturer supplied and field wired control devices shall be identified at each termination with the wire numbers shown on the plans, approved working drawings, and as directed by the Engineer where deemed necessary. Identification shall be made with one of the following:

1. Adhesive backed paper or cloth wrap-around markers with clear, heat shrinkable tubing sealed over either type of marker.
2. Pre-printed, white, heat-shrinkable tubing.

Each terminal block shall have a molded marking strip attached with screws. The identifying numbers of the terminating conductors, as shown on the plans or on the submittal drawings, shall be engraved in the marking strip.

Outlet, Device and Junction Box Installation:

Where exposed threaded steel conduits are connected to an outlet, device, or junction box below switch height, the box shall be a cast metal box. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall be sheet steel boxes. Weatherproof outlet, device and junction boxes shall have cast metal covers with gaskets. Unless otherwise shown on the plans or specified in these special provisions, all other boxes shall have standard galvanized covers.

All boxes shall finish flush with building walls, ceiling and floors except where exposed work is called for.

Raised device covers (plaster rings) shall be installed on all boxes concealed in concrete, masonry or stud walls.

No unused openings shall be left in any box. Knockout seals shall be installed as required to close openings.

Outlet, device, and junction boxes shall be installed at the locations and elevations shown on the plans or specified herein. Adjustments to locations may be made as required by structural conditions and to suit coordination requirements of other trades.

Boxes in stud walls and partitions shall not be mounted back to back. Through-wall boxes shall not be used.

Boxes installed in metal stud walls shall be equipped with brackets designed for attaching directly to the studs or shall be mounted on heavy gauge galvanized steel, snap-in box supports.

Fixture outlet boxes installed in Suspended ceilings of gypsum board or lath and plaster construction shall be mounted on 16-gage metal channel bars attached to main ceiling runners.

Fixture outlet boxes for pendant-mounted fixtures installed in Suspended ceilings supporting acoustical tiles or panels shall be supported directly from the structures above.

Underground Pull Box Installation:

Electrical pull box covers or lids shall be marked "ELECTRICAL." Telephone service pull box covers or lids shall have plain, unmarked covers.

The bottom of pull boxes shall be bedded in 6 inches of clean, crushed rock or gravel and shall be grouted with 1½-inch thick grout prior to installation of conductors. Grout shall be sloped to a one-inch PVC pipe drain hole. Conduit shall be sealed in place with grout.

Ground Rod Installation: The ground rod shall be driven vertically until the top is 6 inches above the surrounding surface. When vertical penetration of the ground rod cannot be obtained, an equivalent horizontal grounding system, approved by the Engineer, shall be installed.

Anchorages:

Hangers, brackets, conduit straps, supports, and electrical equipment shall be rigidly and securely fastened to surfaces by means of toggle bolts on hollow masonry; expansion shields and machine screws, or expansion anchors and studs or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood or lag screws on wood construction.

Anchorage devices shall be installed in accordance with the anchorage manufacturer's recommendations.

Mounting heights: Electrical system components shall be mounted at the following mounting heights, unless otherwise shown on the plans. The mounting height dimensions shall be measured above the finished floor to the bottom of the device or component.

Wall switches	3’-4”
Convenience outlets	2’-0” , office areas 3’-4” , all other areas
Electric water cooler outlet	As recommended by the water cooler manufacturer.
Communication outlets	2’-0” , office areas 3’4” , all other areas

12-16.04 SERVICE

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing service equipment in accordance with the requirements of the serving utilities, the details shown on the plans and these special provisions.

Attention is directed to "Utility Connection" in Section 12-1, "General Requirements," of these special provisions regarding arrangements, permits, licenses, charges, fees and costs for utility connections and extensions.

Related Work: Concrete and reinforcement for service pedestal shall conform to the requirements specified for minor work under “Cast-in-Place Concrete,” in Section 12-3, “Concrete and Reinforcement,” of these special provisions.

SUBMITTALS

Installation Details: The Contractor shall submit complete service installation details to the serving utilities for approval. Prior to submitting installation details to the serving utility, the Contractor shall have said drawings reviewed and stamped "APPROVED" by the Engineer. Submittals shall be approved by the serving utility prior to commencing work.

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the working drawings shall be identified with wire numbers.

PART 2 - PRODUCTS

Service Equipment: Service equipment shall be main switchboard, MSB1, and shall contain 3 sections as shown on the plans for 480/277-volt, 3000-ampere, 3-phase, 4-wire service.

Enclosure: Enclosure shall be NEMA 3R enclosure. Exterior shall be 12-gage and interior shall be 14-gage sheet steel. All screws, latches, hinge pins and similar hardware shall be stainless steel. Circuit breaker shall be operable with the exterior door open. Exterior door shall be lockable with a padlock. Enclosure finish shall be baked enamel or baked thermosetting polyester finish. Switchboard shall be seismic zone 4 qualified. Enclosure shall include a 120-volt heater in each section complete with thermostat with fused disconnect. Pull section and transition structures shall be 3000 A copper bussed.

Service Disconnect Switch: Service disconnect switch shall be 3-pole, 600-volt, 3000-ampere trip, UL1066 Listed insulated case power circuit breaker with shunt trip and ground fault protection. The interrupting capacity of the circuit breaker shall be not less than 85000 amperes (symmetrical) at 600-volt. The ground fault protection system shall be of the Residual Sensing method, “vectorial summation” type. The main circuit breaker shall be provided with an electronic trip unit with LSG functionality. The trip unit shall have integrally mounted phase current sensors and one identically rated current sensor mounted on the neutral bus. Under normal operating conditions, the vectorial sum of all phase currents will total zero. Under ground fault conditions, the residual sum of the sensors will not be zero, initiating an internally powered shunt trip of the circuit breaker. Breaker shall be Eaton/Cutler-Hammer, Seimens, , Square D, , or equal.

PART 3 - EXECUTION

Foundation for service equipment shall be as shown on the plans.

Installation of service equipment shall be in accordance with the requirements of the serving utilities as shown on the approved installation details.

12-16.05 INTEGRATED FACILITIES SWITCHBOARD

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing integrated facilities switchboards (IFS) in accordance with the the details shown on the plans and these special provisions.

Related Work:

Concrete and reinforcement for IFS shall conform to the requirements specified for minor work under “Cast-in-Place Concrete,” in Section 12-3, “Concrete and Reinforcement,” of these special provisions.

Basic materials shall be as specified in "Basic Materials And Methods" in Section 12-16, "Electrical" of the Special Provisions.

Switchboards, panelboards, transformers, automatic transfer switches, transient voltage surge suppressor and other devices installed inside the integrated facilities switchboards shall conform to the requirements specified under "Electrical Equipment" in Section 12-16 "Electrical," of these special provisions.

Lighting Control Panels to be installed inside the integrated facilities switchboard shall conform to the requirements specified for minor work under "Electrical Equipment" in Section 12-16 "Electrical," of these special provisions.

SUBMITTALS

Product Data:

A list of materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval. Any other data as requested by the Engineer shall also be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Master drawing index, front view, floor plans, top view, single line diagram, schematic diagram, assembly ratings, major component ratings, and cable terminal sizes shall be included. The busway connection, connection details and composite floor plan assemblies shall be submitted.

PART 2 - PRODUCTS

Integrated Facilities Switchboard:

Integrated facilities switchboard shall be a free standing, dead front type, low voltage distribution switchboard, utilizing group mounted protective devices, integrated panelboards and other equipment as shown on the plans. The integrated facilities switchboard shall be designed, manufactured and tested in accordance with NEMA PB-2 and UL Standard 891. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Adequate ventilation shall be provided within the enclosure. All sections of the switchboard shall be rear aligned as shown on the plans. All protective devices shall be group mounted. Devices shall be front removable and load connections from accessible enabling switchboards to be mounted against a wall.

All bus bars shall be silver-plated copper. A copper ground bus (minimum ¼ by 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. All hardware used on conductors shall be high-tensile strength and zinc plated. All bus joints shall be provided with conical spring-type washers. Feeders in between units shall be copper.

Panelboards shall be recessed in the IFS enclosure a minimum of 4 inches from the front of the switchboard to allow easy access to line and/or load conductors. Three quarter inch (3/4-inch) breakers shall not be used in any part of the panelboard.

The integrated facilities switchboards shall integrate and assemble panelboards and control panels into the unit as shown on the plans. Control panels shall contain a trim with lockable door. Panelboards shall have door-in-door trim. Trim door shall have 3-point latching and be laser cut to assure proper fit.

The integrated facilities switchboards shall integrate and assemble transformers into the unit as shown on the plans. The transformers shall be secured in a manner that assures the structural integrity of the vertical section and the transformer. Adequate ventilation for the transformer and other installed components shall be provided within the switchboard.

The integrated facilities switchboards shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to contractor supplied floor sills to be set level in concrete per manufacturer's recommendations.

FABRICATION AND TESTING

The integrated facilities switchboards shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard shall be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (10 minute between live parts and ground. The manufacturer shall provide three (3) certified copies of the factory test reports.

PART 3 - EXECUTION

Foundation for integrated facilities switchboards shall be as shown on the plans.

Installation of the integrated facilities switchboard shall be in accordance with the manufacturer's requirements to comply with seismic zone 4 requirements and anchorage details . Seismic certificates shall be submitted with proof of conformance based upon actual shaker test method and not by calculation. The manufacturer of the IFS assembly shall be the manufacturer of the major components within the assembly.

Where a switchboard is shown in the lineup, the switchboard manufacturer shall wire from the associated feeder breaker to the respective panelboard, transformer or automatic transfer switch as shown on the plans.

The Contractor shall perform field adjustments of the protective devices as required to place the equipment n final operating condition. The settings shall be in accordance with the approved short circuit sturdy, protective device evaluation study and protective device evaluation study. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with approved short circuit and protective device coordination study shall be carried out by the contractor at no additional cost to State.

12-16.06 ELECTRICAL EQUIPMENT

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing switchboards, panelboards, starters, disconnect switches, transformers, and related accessories in accordance with the details shown on the plans and these special provisions.

Related Work: Basic electrical materials shall be as specified under "Basic Materials and Methods" elsewhere in Section 12-16.

SUBMITTALS

Product Data:

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Control and wiring diagrams, rough-in dimensions, and component layout shall be included where applicable. All control and power conductors on the working drawings shall be identified with wire numbers.

PART 2 - PRODUCTS

SWITCHBOARDS

General: Switchboards shall be dead-front type low voltage distribution factory assembled switchboard with molded case circuit breakers as shown on the plans. Switchboards shall be designed, manufactured and tested in accordance with NEMA PB-1 and UL Standard 891. Short circuit current ratings and locations shall be as shown on the plans. All bus bars shall be silver plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be base on NEMA standard temperature rise criteria of 65°C over a 40°C ambient (outside the enclosure). Switchboards with neutrals shall have full-size (100 per cent) insulated groundable neutrals. Switchboards shall be Eaton/Cutler-Hammer, Square D Company, or equal.

Switchboard MSB2: Switchboard MSB2 shall be a 3-phase, 4-wire, 480/277-volt, AC switchboard at least 45 inches wide with 3000-ampere lugs only. Switchboard MSB2 shall include 2 sections as shown on the plans. The first section shall be a 3000-ampere copper bussed incoming pull section. The second section shall include the distribution breakers as shown on the plans. MSB2 shall be mounted inside IFS1

Switchboard MSBA: Switchboard MSBA 3-phase, 3-wire, 240-volt, AC switchboard at least 36 inches wide with 1600 ampere lugs only and located inside IFS1.

PANELBOARDS

General: Panelboards shall be indoor type, factory assembled panelboard at least 20 inches wide with hinged door and molded case circuit breakers as shown on the plans. Panelboards shall be designed, manufactured and tested in accordance with UL 67 (Panelboards), UL 50 (Cabinets and boxes) , NEMA PB1 (Panelboards) and Federal Specification W. P. 115C. Short circuit current ratings shall be as shown on the plans. Unless otherwise shown on the plans, panelboards shall be fully rated. All main circuit breakers in panelboards shall be molded case type that are vertically mounted and connected to the vertical bus. Back-fed chassis mounted breakers are not acceptable. Individually mounted panelboards and those integrated in the integrated facilities switchboards shall have door-in-door trim. Both hinged trim and trim door shall utilize a 3-point latching. Main bus bars shall be copper. Bus sizing shall be base on NEMA standard temperature rise criteria of 65°C over a 40°C ambient (outside the enclosure). Panelboards with neutrals shall have full-size (100 per cent) insulated groundable neutrals. Panelboards shall be Eaton/Cutler-Hammer, Square D Company, or equal.

Panelboard 1L: Panelboard 1L shall be 3-phase, 4-wire, 480/277-volt, AC panelboard with 225-ampere main lugs only and mounted inside IFS1.

Panelboard E: Panelboard E shall be 3-phase, 4-wire, 480/277-volt, AC panelboard with 400-ampere main lugs only and mounted inside IFS1.

Panelboard AE: Panelboard AE shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 500-ampere main circuit breaker and mounted inside IFS1. Panel AE shall be able to accommodate 225-ampere frame branch circuit breakers as shown on the plans.

Panelboard 1ME: Panelboard 1ME shall be 3-phase, 3-wire, 240-volt, AC panelboard with 225-ampere main circuit breaker and mounted inside IFS1

Panelboard 1R: Panelboard 1R shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 800-ampere main circuit breaker and mounted inside IFS1.

Panelboard 2R: Panelboard 2R shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 200-ampere main circuit breaker and mounted inside IFS5.

Panelboard 3R: Panelboard 3R shall be flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 4R: Panelboard 4R shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 400-ampere main circuit breaker and mounted inside IFS4.

Panelboard 5R: Panelboard 5R shall be flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 6R: Panelboard 6R shall be indoor type, flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 7R: Panelboard 7R shall be , 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main lugs and mounted inside IFS5.

Panelboard 8R: Panelboard 8R shall be surface-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 9R: Panelboard 9R shall be indoor type, flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 3A: Panelboard 3A shall be surface-mounted, 3-phase, 3-wire, 240-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard EE: Panelboard EE shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker and mounted inside IFS5.

Panelboard FE: Panelboard FE shall be flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard B: Panelboard B shall be 3-phase, 3-wire, 240-volt, AC panelboard with 600-ampere main circuit breaker and mounted inside IFS4.

Panelboard BE: Panelboard BE shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker and mounted inside IFS4.

Panelboard 2L: Panelboard 2L shall be 3-phase, 4-wire, 480/277-volt, AC panelboard with 400-ampere main circuit breaker and mounted inside IFS2. Panel 2L shall be able to accommodate 225-ampere frame branch circuit breakers as shown on the plans.

Panelboard 1S: Panelboard 1S shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 500-ampere main circuit breaker and mounted inside IFS2.

Panelboard C: Panelboard C shall be 3-phase, 3-wire, 240-volt, AC panelboard with 400-ampere main lugs only and mounted inside IFS2.

Panelboard CE: Panelboard CE shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 200-ampere main circuit breaker and mounted inside IFS2.

Panelboard DE: Panelboard DE shall be indoor type, surface mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 60-ampere main circuit breaker.

Panelboard GE: Panelboard GE shall be indoor type, surface mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 2S: Panelboard 2S shall be surface-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 3S: Panelboard 3S shall be surface-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 4S: Panelboard 4S shall be surface-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 5S: Panelboard 5S shall be surface-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 200-ampere main circuit breaker.

Panelboard 6S: Panelboard 6S shall be flush-mounted, top feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 3L: Panelboard 3L shall be 3-phase, 4-wire, 480/277-volt, AC panelboard with 100-ampere main circuit breaker and mounted inside IFS3.

Panelboard 1T: Panelboard 1T shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker and mounted inside IFS3.

Panelboard Z: Panelboard Z shall be 3-phase, 4-wire, 480/277-volt, AC panelboard with 400-ampere main circuit breaker and mounted inside IFSA. Panel Z shall be able to accommodate 225-ampere frame branch circuit breakers as shown on the plans.

Panelboard X: Panelboard X shall be 3-phase, 3-wire, 240-volt; AC panelboard with 400-ampere main lugs and mounted inside IFSA.

Panelboard 1Y: Panelboard 1Y shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 500-ampere main circuit breaker and mounted inside IFSA.

Panelboard 2Y: Panelboard 2Y shall be flush-mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 3Y: Panelboard 3Y shall be surface mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 4Y: Panelboard 4Y shall be surface mounted, bottom feed 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main circuit breaker.

Panelboard 5Y: Panelboard 5Y shall be 3-phase, 4-wire, 208/120-volt, AC panelboard with 100-ampere main lugs and mounted inside IFSA.

BUSWAYS

General: Busway 1A and 2A shall be 3-phase, 3-wire, 400-ampere, 240-volt, AC copper indoor type, sprinkler-proof, plug-in busway with housing ground and with circuit breaker type plug-in units as shown on the plans. Busways and associated fittings shall consist of copper conductors totally enclosed in a 2-piece extruded aluminum housing. Busbars shall be fabricated from high strength 98% conductivity copper and suitably plated at all electrical contact surfaces. Busways shall be designed, manufactured and tested in accordance with NEMA BU.1, and ANSI/UL 857. Each busway shall be 20 ft long with housing ground and complete with end cable tap box. Busways shall have a minimum of 6 cycle short-circuit rating of 85 kA (RMS symmetrical). Busways shall have plug-in openings provided on both sides of the busway sections on 24-inch centers. Plug-in covers shall be provided to prohibit dirt and debris from entering contact plug-in openings in the busways. Contractor shall furnish and install all necessary fittings, hangers and accessories. Busway shall be suitable and certified to meet all applicable seismic requirements for zone 4 application. One spare set of joint covers shall be provided for each busway. Busways shall be Eaton/Cutler Hammer, Pow-R-Way-III; Square D Company, I-Line Busway; or equal.

The 3200 A busway shall be similar to Busways 1A and 2A except the 3200 A busway shall be rated at 3200 A, 3-phase, 4-wire, 480/277-volt, AC copper outdoor feeder busway with housing ground. Busway shall be complete with end connections, wall and switchboard flanges as required and supplied by the manufacturer for connection between MSB1 and MBS2.

STARTERS

Chiller Circulating Pump No. 1 Starter: Chiller circulating pump no. 1 starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA Type 3R enclosure. Starter shall have double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Reset button shall be externally operable. Starter coil voltage shall suit the HVAC control system. Fuses and control transformer shall be provided as required to be compatible with the HVAC control system. Starter shall have one normally open and one normally closed contacts for connection to the HVAC control system.

Chiller Distribution Pump No. 1 Starter: Chiller distribution pump no. 1 starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA Type 3R enclosure. Starter shall have double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Start-stop and reset button shall be externally operable. Starter coil voltage shall suit the HVAC control system. Fuses and control transformer shall be provided as required to be compatible with the HVAC control system. Starter shall have one normally open and one normally closed contacts for connection to the HVAC control system.

Boiler Circulating Pump no. 1 Starter: Boiler circulating pump no. 1 starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA Type 1 enclosure. Starter shall have double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Start-stop and reset button shall be externally operable. Starter coil voltage shall suit the HVAC control system. Fuses and control transformer shall be provided as required to be compatible with the HVAC control system. Starter shall have one normally open and one normally closed contacts for connection to the HVAC control system.

Boiler Distribution Pump no. 1 Starter: Boiler distribution pump no. 1 starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA Type 1 enclosure. Starter shall have double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Start-stop and reset button shall be externally operable. Starter coil voltage shall suit the HVAC control system. Fuses and control transformer shall be provided as required to be compatible with the HVAC control system. Starter shall have one normally open and one normally closed contacts for connection to the HVAC control system.

Dust Collector Starter: Dust Collector starter shall be combination 3-pole, 480-volt, NEMA Size 1, NEMA rated, line voltage starter and motor circuit protector in a NEMA Type 3R enclosure. Starter shall have two 2-ampere, dual element, 600-volt fuses with 2-pole barrier type fuse base, 480-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Starter shall have one normally open auxiliary contact.

Badger Jaw Crusher Starter: Badger jaw crusher starter shall be combination 3-pole, 240-volt, NEMA Size 1, NEMA rated, line voltage starter and non-fusible disconnect switch in a NEMA Type 12 enclosure. Starter shall have one 2-ampere, dual element, 240-volt fuse with fuse base, 120-volt coil, double-break silver contacts and 3 manual reset, non-adjustable thermal overloads, set to trip between 115 and 125 percent of full load motor current, as quoted on the nameplate by the motor manufacturer. Start-stop and reset button shall be externally operable. Starter shall have one normally open auxiliary contact.

SWITCHES AND DISCONNECTS

Transformer Secondary Disconnects: Transformer secondary disconnects shall be 3-pole, 600-volt, AC molded case circuit breakers mounted in the IFS. Ampere trip ratings shall be as shown on the plans. Transformer secondary main disconnects shall be Eaton/Cutler-Hammer, Square D Company, or equal.

Plug-in Disconnects: Plug-in disconnect shall be 3-pole, 240-volt, AC molded case circuit breakers. Ampere trip ratings shall be as shown on the plans. Plug-in disconnects shall meet requirements of UL 489 and shall be from the same manufacturer as the busway. Pug-in disconnects shall be mechanically interlocked with the busway housing to prevent their installation or removal while the switch is in the "ON" position. The enclosure of any plug-in unit shall make positive ground connection to the duct housing before the stabs make contact with the bus bars. The operating handle mechanism shall remain in control of the disconnect device at all times, permitting its easy operation from the floor by means of a hook stick. One hookstick shall be provided per each plug-in disconnect. Bottom of the hook stick shall be at 6'- 6" and shall clear aisle way.

Grieve HY 500 Oven Isolating Switch: Grieve HY 500 oven isolating switch shall be 3-pole, 600-volt, AC, 100-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 1 enclosure.

Kneading Compactor Isolating Switch: Kneading compactor isolating switch shall be 3-pole, 600-volt, AC, 30-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 1 enclosure.

Despatch LBB218 Oven Isolating Switch: Despatch LBB218 oven isolating switch shall be 2-pole, 600-volt, AC, 30-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 1 enclosure.

Grieve 333 Oven Isolating Switch: Grieve 333 oven isolating switch shall be 2-pole, 600-volt, AC, 60-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 1 enclosure.

Abrasion Machine Isolating switch: Abrasion machine isolating switch shall be 2-pole, 600-volt, AC, 30-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 12 enclosure.

Badger Jaw Crusher Isolating switch: Badger jaw crusher isolating switch shall be 3-pole, 600-volt, AC, 30-ampere non-fusible heavy duty safety switch in a surface mounted NEMA Type 1 enclosure.

Ramp Operator Isolating Switch: Ramp operator disconnect switch shall be 3-pole, 600-volt, AC, 30-ampere, non-fusible, heavy duty safety switch in a NEMA Type 3R enclosure with provision for padlocking in the "OFF" position.

Sump Pump Isolating Switch: Sump pump isolating switch shall be 2-pole, 600-volt, AC, 30-ampere, non-fusible, heavy duty safety switch in a NEMA Type 3R enclosure with provision for padlocking in the "OFF" position.

Fork Lift Isolating Switch: Fork Lift isolating switch shall be 3-pole, 600-volt, AC, 60-ampere, non-fusible, heavy duty safety switch in a NEMA Type 3R enclosure with provision for padlocking in the "OFF" position.

Concrete Saw Blade Isolating Switch: Concrete saw blade isolating switch shall be 2-pole, 600-volt, AC, 30-ampere, non-fusible, heavy duty safety switch in a NEMA Type 3R enclosure with provision for padlocking in the "OFF" position.

Sheldon HF372 Isolating Switch: Sheldon HF372 isolating switch shall be 2-pole, 600-volt, AC, 100-ampere, non-fusible, heavy duty safety switch in a NEMA Type 1 enclosure with provision for padlocking in the "OFF" position.

Compression Machine Disconnect Switch: Compression machine Disconnect switch shall be 3-pole, 240-volt, AC, 30-ampere molded case circuit breaker in a NEMA Type 1 enclosure.

Kneading Compactor Disconnect Switch: Kneading Compactor disconnect switch shall be 3-pole, 240-volt, AC, 20-ampere molded case circuit breaker in a NEMA Type 1 enclosure .

Air Compressor Isolating Switch: Air compressor isolating switch shall be 3-pole, 240-volt, AC, 60-ampere non-fusible heavy duty safety switch in a NEMA Type 1 enclosure.

Air Dryer Isolating Switch: Air dryer isolating switch shall be single-pole, 120/277-volt, AC, 20-ampere snap switch in a NEMA Type 1 enclosure.

Roll-up Door Operator Isolating Switch: Roll-up door operator isolating switch shall be single-pole, 120/277 volt, 20-ampere snap switch switch in a NEMA-1 enclosure.

A/C Outdoor Disconnect Switch: Outdoor A/C disconnect switch shall be 2-pole, 240-volt, AC, 60-ampere, fused, safety switch with a 20 A, 125 volt duplex ground fault interrupter receptacle in a NEMA Type 3R enclosure. Fuses shall be sized to suit A/C unit furnished.

A/C Indoor Disconnect Switch: A/C indoor disconnect switch shall be single-pole, 120/277-volt, AC, 20-ampere snap switch.

Fan Coil Double-pole Disconnect Switch: Fan coil double-pole disconnect switch shall be 2-pole, 277-volt, AC, 20-ampere snap switch. Connect the neutral conductor to the second pole for 120 volt rated fan coil units.

TRANSFORMER

Transformers: Transformer shall be indoor, dry type, IFS mounted, energy efficient, transformer. Transformer shall be NEMA TP-1 compliant. Transformer shall have two 2 1/2 percent full capacity taps above and four 2 1/2 percent full capacity taps below normal primary voltage, copper windings and 150°C temperature rise. Transformers shall be Eaton/Cutler-Hammer, Energy Star NEMA TP-1; Square D Company; or equal.

Transformer ET1: Transformer ET1 shall be 3-phase, 480-volt primary, 208/120-volt secondary, 150 kVA and mounted in IFS1. Transformer ET1 shall have a built-in harmonic current suppression system.

Transformer ET2: Transformer ET2 shall be 3-phase, 480-volt primary, 240-volt secondary, 75 kVA and mounted in IFS1.

Transformer RT: Transformer RT shall be 3-phase, 480-volt primary, 208/120-volt secondary, 225 kVA and mounted in IFS1. Transformer RT shall have a built-in harmonic current suppression system.

Transformer AT: Transformer AT shall be 3-phase, 480-volt primary, 240-volt secondary, 500 kVA and mounted in IFS1.

Transformer ST: Transformer RT shall be 3-phase, 480-volt primary, 208/120-volt secondary, 150 kVA and mounted in IFS2. Transformer ST shall have a built-in harmonic current suppression system.

Transformer CT: Transformer CT shall be 3-phase, 480-volt primary, 240-volt secondary, 112.5 kVA and mounted in IFS2.

Transformer TT: Transformer TT shall be 3-phase, 480-volt primary, 208/120-volt secondary, 30 kVA and mounted in IFS3.

Transformer YT: Transformer YT shall be 3-phase, 480-volt primary, 208/120-volt secondary, 150 kVA and mounted in IFSA. Transformer YT shall have a built-in harmonic current suppression system.

Transformer XT: Transformer XT shall be 3-phase, 480-volt primary, 240-volt secondary, 112.5 kVA and mounted in IFSA.

MISCELLANEOUS MATERIALS

Automatic Transfer Switch ATS: Automatic transfer switch shall be as specified under “Standby Generator” of these special provisions.

Built-in Harmonic Current Suppression System: Built-in harmonic current suppression system shall be a passive device installed at the secondary of a wye connected distribution transformer rated at 120/208 volt, 60 hertz. The system shall be totally passive in operation and shall not contain any electronic switching devices. The system shall be operative to remove harmonic currents on all three phase wires and the neutral wire of a power system loaded with single-phase non-linear loads connected phase to neutral. The system shall be protected by the same circuit breaker that protect the phase wires for the transformer. The system shall be capable of handling the full rated load of the transformer and shall not require resizing as the transformer is loaded to its full capacity with non-linear loads. The system shall block the flow of harmonic current of the frequency of 3rd harmonic of the fundamental.

Transient voltage Surge Suppressor TVSS: Transient voltage surge suppressor TVSS shall be a service entrance type surge protection equipment able to withstand 250 kA surge current. . The TVSS shall be provided with a 30-ampere disconnect that is directly integrated to the suppressor and assembly bus using bolted bus bar connections. The TVSS unit shall be designed, manufactured and tested in accordance to UL 1449 (2nd Edition), UL 1283 and CSA 22.2. The TVSS shall be complete with status indicator lights on each phase, audible alarm, enable/disable transient counter and push to test pushbutton.

Ground Fault Circuit Interrupter (GFCI) Type Circuit Breakers: GFCI type circuit breakers shall detect and trip at current leakage of 6 milliamperes or more.

Dust Collector Pushbutton: Dust collector pushbutton shall be a heavy duty, oil tight, 2-button unit in a surface mounted NEMA Type 1 enclosure. Contact rating shall be 15-ampere(make), 1.5-ampere (break) and 10-ampere (continuous) at 480-volt, AC and 35 per cent power factor. Pushbutton shall have a "Star-stop" escutcheon plate.

Badger Jaw Crusher Emergency Pushbutton: Badger jaw crusher emergency pushbutton shall be a heavy duty, oil tight, single-button, maintained contact, turn-to release, normally closed pushbutton in a surface mounted NEMA Type 12 enclosure. Button shall be 2 ½-inch diameter, red mushroom type button. Contact rating shall be 30-ampere(make), 3-ampere (break) and 10-ampere (continuous) at 240-volt, AC and 35 per cent power factor. Pushbutton shall have an "Emergency Stop" escutcheon plate.

Bypass Pushbutton: Bypass pushbutton shall be as specified under "Lighting" in these special provisions.

Nameplates: Nameplates shall be laminated phenolic plastic with white core and black front and back. Nameplate inscription shall be in capitals letters etched through the outer layer of the nameplate material.

Device Labels: Unless otherwise specified, device labels shall be an industrial type, pre-printed labels with adhesive backed with white core and black front and back. Labels shall resist fading, scratching, moisture, heat, chemicals, ultra-violate (UV) exposure and cleaning fluids. Device labels shall be K-Sun Co Labels; Dymo Letra Tag; or equal.

Plywood Backing Board: Plywood backing board for mounting electrical or telephone equipment shall be ¾-inch, APA plywood panels, C-D PLUGGED and touch-sanded, Exposure 1.

PART 3 - EXECUTION

INSTALLATION

Plywood Backing Board:

Plywood backing board shall be securely fastened to walls or other vertical framing.

Surface to be coated shall be cleaned of all dirt, excess materials, of filler by hand cleaning.

Plywood backing board exposed surfaces shall receive the following paint system: one prime coat, alkyd, interior wood primer and 2 finish coats, acrylic, interior enamel, semi-gloss. Color shall match surrounding surfaces, or shall be as directed by the Engineer.

Coatings shall be applied in accordance with the manufacturer's instructions. Each coat shall be applied to a uniform finish, free of skips, brush marks, laps or other imperfections.

Panelboard Installation:

Set cabinets plumb and symmetrical with building lines. Train interior wiring as specified under "Conductor and Cable Installation" in "Basic Materials and Methods" of these special provisions. Touch-up paint any marks, blemishes, or other finish damage suffered during installation. Replace cabinets, doors or trim exhibiting dents, bends, warps or poor fit which may impede ready access, security or integrity.

Mounting height shall be 5½ feet to the highest circuit breaker handle, measured above the finished floor.

Provide three ¾-inch empty conduits from flush panelboard enclosure to a point above furred ceiling for each 16 circuits or fraction thereof in each panelboard.

Where "Space" is indicated on the plans, branch connectors, mounting brackets, and other hardware shall be furnished and installed for future breaker.

A typewritten directory under transparent protective cover shall be provided and set in metal frame inside each cabinet door. Directory panel designation for each circuit breaker shall include complete information concerning equipment controlled, including room number or area designated on the plans.

Transformer Installation: Connect primary to minimum value taps during construction period and prior to initial building start-up. Make voltage readings and adjust tap connections to nominal voltage during final construction review and prior to building occupancy. Install conduit connections that will prevent transmission of the transformer vibrations to the conduit system. Transformers shall be bolted to floor when floor mounted and bolted to wall with support brackets when wall mounted. Pad mounted transformers (unit substation) shall be installed as shown on the plans.

Disconnect Switches and Isolating Switches Installation: Unless otherwise noted on the plans, mounting height shall be 4-feet above finished floor.

Equipment Identification:

Equipment shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts.

Nameplate inscriptions shall read as follows:

1. Inscriptions for panelboards and switchboards shall include designation, voltage, amperes and phase of supply and shall read in the following example: PANEL A, 120/208 volt, 225 A, 3-PHASE, 4-WIRE.

2. Inscription for disconnect switches, isolating switches and pushbuttons shall be the respective device it is controlling and shall read in the following example: GRIEVE HY 500 OVEN.

3. Inscription for lighting control stations shall be the panel designation as shown in the plans and shall read in the following example: OUTDOOR LIGHTING CONTROL STATION; and

4. Inscription for plug-in disconnect switches, shall include designation, voltage, amperes, and phase of supply read in the following example: GRIEVE HY 500 OVEN, 240 volt, 70 A, 3-PHASE.

5. Ceiling mounted and wall mounted junction boxes for future equipment shall have the amperes, voltage, phase, panel and circuit numbers of circuits terminated in the boxes. For example the ceiling mounted junction box for circuit C13-15-17 shall read: 40 A, 240 volt, 3 PHASE, C13-15-17.

Pushbutton stations and timer switches shall be identified with nameplates fastened with self-tapping, cadmium-plated screws or nickel-plated bolts adjacent to the unit. Inscription shall be the particular device the pushbutton or switch is controlling. For example the badger jaw crusher emergency stop pushbutton shall have a nameplate adjacent to it that reads “BADGER JAW CRUSHER”.

Device Labels:

All receptacle outlets shall be provided with device labels. Device labels for receptacle outlet shall be the voltage, phase, amperes, panelboard number and circuit number in the following example: 120 volt, 1-phase, 20 A, 1R 25. GFCI protected receptacles shall include the inscription that reads “GFCI PROTECTED” on the label.

All communication outlets shall be provided with device labels. Device labels for communication outlets shall be the room number, closet number and jack number. Closet number for MDF/Phone Rm shall be designated as “A” and closet number for the IDF Room shall be designated as “B”. The closet number for the IDF Room in the IA Building shall be designated as “C”.

12-16.07 LIGHTING

PART 1 – GENERAL

Scope: This work shall consist of furnishing, installing and connecting all lighting equipment in accordance with the details shown on the plans and these special provisions.

Related Work: Basic materials shall be as specified in Section 12-16 "Basic Materials And Methods" of these Special Provisions.

SUBMITTALS

A list of all materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval.

Manufacturer's descriptive information, photometric curves, catalog cuts, and installation instructions shall be submitted for approval.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification.

PART 2 - PRODUCTS

Wall Switch Occupancy Sensor, Type 1: Wall switch occupancy sensor, type 1 shall be a wall-mounted, passive infrared (PIR) sensor switch with time delay. Switch shall be rated at 800 W (minimum) incandescent or 1200 VA (minimum) fluorescent at 120-volt (ac) and operate on 120/277-volt (ac). The switch shall be capable of manual-on/automatic off mode. The sensor switch shall cover a minimum of 900 square feet of floor area, be suitable for installation in a single gang box, and shall have a field of view of not less than 180 degrees. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. Sensor shall be compatible with all electronic ballasts and shall have no leakage to load in the “OFF” mode.

Wall Switch Occupancy Sensor, Type 2: Wall switch occupancy sensor, type 2 shall be a wall-mounted, passive infrared dual relay sensor switch with time delay. Primary relay shall be rated at 800 W (minimum) incandescent or 1200 VA (minimum) fluorescent at 120-volt (ac). Secondary relay shall be rated at 800 W (minimum) incandescent or 800 VA (minimum) fluorescent at 120-volt. Switch shall operate on 120/277-volt (ac). The relays in the sensor shall be capable of simultaneously controlling 2 different lighting loads or circuits. The second relay shall be independent allowing for two circuit control. The unit shall have dual manual override switches that can be used to toggle manual-on/automatic off mode for each lighting load. Sensor shall have audible alert to indicate impending light shut off. The sensor switch shall cover a minimum of 100 square feet of floor area, be suitable for installation in a single gang box, and shall have a field of view of not less than 180 degrees. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. Sensor shall be compatible with all electronic ballasts and shall have no leakage to load in the “OFF” mode.

Wall Mounted Occupancy Sensor, Type 3: Wall mounted occupancy sensor, type 3 shall be a low voltage, passive infrared (PIR) sensor switch. Switch shall have an adjustable time delay. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor switch shall cover a minimum of 90 ft long by 16 ft wide when mounted at 10 ft high. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. Switch shall be provided with a swivel mounting bracket or a twist and lock base mounting hardware for fast alignments.

Ceiling Mounted Occupancy Sensor, Type 1: Ceiling mounted occupancy sensor, type 1 shall be alow voltage, ultrasonic occupancy sensor switch with a 32 kHz frequency. Sensor shall contain angled transmitter and receiver pairs. Switch shall have an adjustable time delay. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor switch shall cover a minimum of 600 square feet of floor area. Switch shall have a field of view of not less than 360 degrees, conical pattern. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Ceiling Mounted Occupancy Sensor, Type 2: Ceiling mounted occupancy sensor, type 2 shall be a low voltage, ultrasonic occupancy sensor switch with a 32 kHz frequency. Sensor shall contain angled transmitter and receiver pairs. Switch shall have an adjustable time delay. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor switch shall cover a minimum of 1100 square feet of floor area. Switch shall have a field of view of not less than 360 degrees, conical pattern. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Ceiling Mounted Occupancy Sensor, Type 3: Ceiling mounted occupancy sensor, type 3 shall be a low voltage, ultrasonic occupancy sensor switch with a 32 kHz frequency. Sensor shall contain angled transmitter and receiver pairs. Switch shall have an adjustable time delay. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor switch shall cover a minimum of 2200 square feet of floor area. Switch shall have a field of view of not less than 360 degrees, conical pattern. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Pendant Mounted Occupancy Sensor: Pendant mounted occupancy sensor shall be a low voltage, passive infrared occupancy sensor with dual element, temperature compensated pyroelectric sensor. Switch shall have an adjustable time delay. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor switch shall cover a minimum of 1200 square feet of floor area. Switch shall have a field of view of not less than 360 degrees, conical pattern. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Corner Mounted Occupancy Sensor: Corner mounted occupancy sensor shall be a low voltage, passive infrared occupancy sensor with dual element, temperature compensated pyroelectric sensor. Switch shall operate on 24 volt (dc) and shall be provided with a power pack unit. The sensor shall be suitable for corner mount and shall have a dense wide angle lens. The sensor switch shall cover a minimum 2000 square feet of walking motion. Switch shall have an adjustable time delay. The time delay off setting shall be adjustable from 30 seconds to 30 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled.

Wall Mounted Occupancy Sensor, Type 1: Wall mounted occupancy sensor, type 1 shall be a line voltage, 277 volt, passive infrared outdoor motion sensor. Switch shall have an integral single-pole, double throw isolated relay rated at 1000 watts ballast load. The switch shall have a long range coverage, 50 ft when mounted at 8 ft high. Switch shall have an adjustable time delay. The time delay off setting shall be adjustable from 12 seconds to 16 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled. Sensor shall be compatible with all electronic ballasts. Sensor shall have ON/OFF control based on daylight, adjustable from 0.4 to 42 footcandles.

Wall Mounted Occupancy Sensor, Type 2: Wall mounted occupancy sensor, type 2 shall be a line voltage, 277 volt, passive infrared outdoor motion sensor. Switch shall have an integral single-pole, double throw isolated relay rated at 1000 watts ballast load. The switch shall have a 90 degree coverage, 40 ft when mounted at 8 ft. Switch shall have an adjustable time delay. The time delay off setting shall be adjustable from 12 seconds to 16 minutes, initially set at 10 minutes. The sensor shall have LED indicator that remains active at all times in order to verify detection within the area to be controlled. Sensor shall be compatible with all electronic ballasts.

Power Pack Unit (Occupancy Sensor): Power pack unit (Occupancy Sensor) shall be a combination 24 volt (dc) power supply and a 20 A line voltage relay. Power supply shall be a self-contained transformer with 24 volt (dc) and minimum 150 mA output. Input voltage to power pack unit shall be suitable for 120/277 volt (ac). Relay shall be Class B (130ºC) insulating material and have a contact rating of 20 A at 120/277 volts (ac). Power pack unit and occupancy sensor shall be from the same manufacturer. Power pack unit shall be mounted inside a junction box.

Auxiliary Relay Pack: Auxiliary relay pack shall include an additional relay mounted inside a junction box. Relay shall match the relay provided in the power pack unit.

Timer Switch - Digital: Timer switch - digital shall be an electronic interval timer switch with a manually operated toggle switch or pushbutton. Switch shall be rated 1200-watt ballast at 230/277-volt, AC. Time adjustments shall range from 5 minutes to 12 hours, initially set at 4 hours. Switch shall have an audible warning that beeps every 5 seconds at one minute prior to time out.

Timer Switch - 3-way: Timer switch - 3-way shall be an electronic interval timer switch with a manually operated toggle switch that can be operated as a 3-way switch. Switch shall be rated 1100-watt ballast at 277-volt, AC. Time adjustments shall range from 5 minutes to 12 hours, initially set at 8 hours. Switch shall have an audible warning that beeps prior to time out.

Lighting Fixture Lamps: Lighting fixture lamps shall be 277-volts, type and size as shown on the plans. Lamps shall be General Electric, Phillips, Sylvania, or equal. Fluorescent lamps, unless otherwise noted, shall be 4100K tri-phosphor with a CRI of 70 or greater.

Ballasts: All fixtures shall be equipped with high power factor ballasts suitable for the 277-volt line voltage and for the type, size and number of lamps required by the fixture. Fluorescent ballasts shall be UL Listed, Class P and ETL Certified ballasts with sound rating A. Fluorescent ballasts shall be high-frequency electronic ballasts with power factor greater then 0.95, nominal ballast factor of 0.88 unless specified otherwise, total harmonic distortion less than 20 percent, crest factor less than or equal to 1.7, complying with ANSI C 62.41 Category A for surge protection, and FCC Part 18 for interference. Dimming ballasts shall be high frequency ballasts as specified above and shall be capable of dimming the light output from 100 percent to 20 percent of the rated light output.

Emergency Battery Pack unit: Emergency battery pack unit shall be a factory installed, self-contained emergency ballast that converts fluorescent fixtures into emergency lighting fixtures. The unit shall consist of a battery, charger and electronic circuitry in one compact case. Unit shall include a charging indicator and test switch. Ballast for fixtures with 32-watt T8 lamps shall be able to operate one or two lamps at 1400 lumens. Ballast shall be capable of operating two 32-watt T8 lamps for a minimum or 90 minutes. Ballast for fixtures with 13-watt double tube lamps shall be able to operate one compact double tube, 13-watt lamp for a minimum of 90 minutes. Ballast shall be compatible with electronic ballast and shall be rated for 120/277 volt, AC.

Lighting Fixtures: Lighting fixtures shall be as shown on the plans and as specified herein. Outdoor luminaires shall be UL listed and labeled "Fixture Suitable For Wet Locations."

F1: Ceiling-mounted fluorescent fixture with T-8 lamp, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Lithonia, CB Series ; Columbia, Prestige II Series; or equal.

F2: Pendant or ceiling-mounted fluorescent fixture with two 32-watt T-8 lamps, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Lithonia, LB Series; Columbia, Prestige Premium Series; or equal.

F3: Pendant or ceiling -mounted fluorescent fixture with three 32-watt T-8 lamps, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Lithonia, LB Series; Columbia, Prestige Premium Series; or equal.

F4: Wall-mounted angled wraparound fluorescent fixture with two 32-watt T-8 lamps, electronic ballast and one-piece, clear acrylic, wrap-around diffuser. The fixture shall be Holophane, WA Series; Kennal, Mighty Mac Series; or equal.

F5: Lay-in 2' x 4' parabolic troffer fluorescent fixture with two 20-watt T8 lamps, electronic dimming ballast and 18-cell 3-inch louvers. The fixture shall be Columbia, P4 Parabolic Series; ; Lithonia, Paramax Series; or equal.

F6: Lay-in 2' x 4' parabolic troffer fluorescent fixture with three 32-watt T8 lamps, electronic ballast and 18 cell 3-inch louvers. The fixture shall be Columbia, P4 Parabolic Series; Lithonia, Paramax Series ; or equal.

F7: Lay-in 2' x 4' lensed troffer fluorescent fixture with three 32-watt T8 lamps, electronic dimming ballast and 18 cell 3-inch louvers. The fixture shall be Columbia, P4 Parabolic Series; Lithonia, Paramax Series; or equal.

F8: Lay-in 2' x 4' lensed troffer fluorescent fixture with four 32-watt T8 lamps, electronic ballast and 18 cell 3-inch louvers. The fixture shall be Columbia, P4 Parabolic Series; Lithonia, Paramax Series; or equal.

F9: Lay-in 2’ x 4’ lensed troffer fluorescent fixture with four 32-watt T8 lamps, electronic dimming ballast and 18 cell 3-inch louvers. The fixture shall be Columbia, P4 Parabolic Series; Lithonia, Paramax Series; or equal.

F10: Pendant mounted channel industrial fluorescent fixture with one 32-watt T8 lamps, electronic ballast and white hood reflector. Channel shall be 22-gauge steel and hoods shall be made with at least 90 percent reflectivity metal. Fixture shall be Holophane, SN Series; Day-Brite, Industrial Silverado Series; or equal.

F11: Pendant mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast and white baked enamel solid top reflector complete with white straight blade louver assembly and end plates. Fixture shall be Lithonia, MS8 Series; Daybrite, EQ Series; or equal.

F12: Bracket mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast and white baked enamel solid top reflector complete with with white straight blade louver assembly and end plates. Fixture shall be Lithonia, MS8 Series; Daybrite, EQ Series Series; or equal.

F13: Pendant mounted industrial fluorescent fixture with three 32-watt T8 lamps, electronic ballast and white baked enamel solid top reflector complete with with white straight blade louver assembly and end plates. Fixture shall have wide distribution. Fixture shall be Lithonia, MS8 Series; Daybrite, EQ Series Series; or equal.

F14: Surface mounted industrial fluorescent fixture with four 32-watt T8 lamps, electronic ballast and white baked enamel solid top reflector complete with white straight blade louver assembly end plates. Fixture shall be Lithonia, HL Series; Holophane, IW Series; or equal.

F15: Recessed, compact, lensed, downlight fluorescent fixture with two 13 watt twin tube lamps, integral ballast. Fixture shall be IC rated. Fixture depth shall not exceed 15 inches. Fixture shall be Lithonia, Wallwash Series; Prescolite, Wallwash Series; or equal.

F16: Surface or bracket mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast with fully gasketed enclosed fiberglass housing. Fixture shall be suitable for listed for damp locations. Fixture shall be Lithonia, DM Series; Columbia, LUN4 Series; or equal.

F17: Pendant mounted industrial fluorescent fixture with three 32-watt T8 lamps, electronic ballast with fully gasketed enclosed fiberglass housing. Fixture shall be suitable for listed for damp locations. Fixture shall be Lithonia, DM Series; Columbia, LUN4 Series; or equal.

F18: Pendant mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast with fully gasketed enclosed fiberglass housing. Fixture shall be suitable for listed for damp locations. Fixture shall be Lithonia, DM Series; Columbia, LUN4 Series; or equal.

F19: Pendant mounted fluorescent fixture with three 32-watt T-8 lamps, electronic dimming ballast and white baked enamel reflector complete with white straight blade louver assembly and end plate. Fixture shall have wide distribution. The fixture shall be Lithonia, MS8 Series; Daybrite, EQ Series; or equal.

F20: Surface mounted industrial fluorescent fixture with two 32-watt T8 lamps, electronic ballast with fully gasketed enclosed fiberglass housing. Fixture shall be suitable for listed for wet locations. Fixture shall be Lithonia, DMW Series; Columbia, LUN4WL Series; or equal.

F21: Wall washer fluorescent fixture with one 26-watt triple tube compact fluorescent lamp and electronic integral ballast. Fixture shall have hinged and latched tempered glass lens complete with adjustable aiming system and mounting arm. Fixture housing shall be die cast aluminum and shall not have any exposed fasteners or visible hardware. The fixture shall be LAM Lighting, Horizons Series; Cooper Lighting, Ametrix Roundel Series; or equal.

MH1: Outdoor, surface mounted, 50-watt, 277-volt metal halide luminaire with integral ballast. Fixture shall have seamless, die cast housing, 12-inch square housing and maximum 6.5 inches height. Lens shall be clear tempered glass enclosed in a hinged frame.

MH2: Wedge wall sconce, 50-watt, 277-volt metal halide luminaire with integral ballast. Fixture shall be die cast aluminum with clear tempered glass. Fixture shall be suitable for wet locations. The fixture shall be Cooper Lighting, 682-WP Series; Bega Architectural Lighting, Wall-flood 2417MH Series; or equal.

MH3: Recessed mounted, round luminaire with one 50-watt metal halide lamp and integral ballast. Reflector shall be spun aluminum. Fixture shall be suitable for wet locations. Fixture shall have a vertically mounted medium base glazed porcelain sockets. Luminaire shall have UV absorbing tempered low brightness prismatic glass and self flanged trim. Opening shall not exceed 6 inches in diameter. Fixture shall have a fused primary. Housing shall be rustproof and entire luminaire shall be capable of being serviced through removable trim assembly.

Daylight Control Station, DLCS1 thru DLCS4E: Daylight control station shall consist of a factory assembled control panel consisting of a disconnect switch, photocontroller, power pack unit, lighting contactor, time delay relay and terminal block mounted in one of the compartment in the integrated facilities switchboard. DLCS4E shall have a time clock mounted inside.

Disconnect Switch: Disconnect switch shall be a 30-ampere, 600-volt, 3-pole nonfusible switch with a flange mounted handle.

Photocontroller: Photocontroller shall be an automatic multi-level daylighting switching control module that provides up to 3 zones of control from a single photocell. Photocontroller shall automatically switches lighting load in response to natural daylight utilizing remotely mounted photosensors. Photocontroller shall include the following features: set point range from 5 to 60 footcandles; time delay to prevent intermittent or false switching; adjustable “on” delay from 5 to 60 seconds; adjustable “off” delay from 3 to 60 minutes; load shed point from 5 to 60 footcandles; programmable deadband from 10 per cent to 80 per cent and menu-driven pushbutton programming without the need for special tools. The photocontroller shall include circuit board output relays and built-in timers. The control module shall receive input from the photoelectric unit.

Power Pack Unit (Photocontroller): Power pack unit (Photocontroller) shall be a power supply unit that is compatible with the photocontroller. Unit shall be suitable for 277 volt input and shall be capable of supplying low voltage to the photocontroller and photoelectric cell unit. It shall connect to the photocontroller via a quick connect cable. Unit shall have three normally open relays that shall be used to switch line voltage in response to signals from the photocontroller. Relay contacts shall be rated 620 VA at 277 volt. The power pack shall have an automatically resetting fuse.

Photoelectric Unit, PEC1: Photoelectric unit, PEC1, shall be photocell unit that utilizes a photodiode element to continuously measure ambient light levels. Photoelctric cell unit shall be compatible with the phtocontroller that is provided. The photocell shall read from 3 footcandles to 60,000 footcandles.

Lighting Contactor: Lighting contactor shall be electrically held, combination lighting contactor with 277-volt AC coil and 30-ampere, double-break, silver alloy contacts; Square D Company, I.T.E., Westinghouse, or equal. Number of poles shall be as shown on the plans.

Time delay relay: Time delay relay shall be an industrial, electro-pneumatic timing relay with 277-volt, AC, coil, sealed gas chamber, and double-pole, double-throw, double-break contacts having a capacity of 10 amperes at 120 volts, AC. Relay shall have time delay on de-energizing adjustable from 6 to 60 minutes, initially set at 60 minutes.

Bypass pushbutton: Bypass pushbutton shall be heavy duty, oil-tight, momentary pushbutton with one normally open contact. Each contact shall have an inductive pilot duty rating of 15 amperes (make), 1.5 amperes (break) and 10 amperes (continuous) at 480 volts and 35 percent power factor.

Lighting Control Station, LCSA: Lighting control station shall be a factory assembled lighting control station and shall consist of a disconnect switch, time clock, lighting contactors, selector switch, time delay relay and terminal block.

Lighting Contactor: Lighting contactor shall be electrically held, combination lighting contactor with 277-volt AC coil and -ampere, double-break, silver alloy contacts; Square D Company, I.T.E., Cutler-Hammer , or equal.

Selector Switch, SS: Selector switch shall be rotary action, double-pole, 3-position, 10-ampere, 480-volt switch. Switch contacts shall have an inductive pilot duty rating of 15 amperes (make), 1.5 amperes (break) and 10 amperes (continuous) at 480 volts and 35 percent power factor. Selector switch shall have legend plate marked MANUAL-OFF-AUTO.

Outside Light Control Stations, OLCS1 and OLCSA: Outside light control station shall be a factory assembled lighting control station and shall consist of a disconnect, time clock lighting contactors, terminal block, bypass timer switches, and pilot lights.

Bypass Timer Switches: Bypass timer switches shall be a 10-ampere, 277-volt AC, single pole-single throw, spring wound, mechanical timer switches that requires no electricity to operate. Switch shall have a 2-hour range without a "hold" position.

Time clock: Time clock shall be a 277-volt, AC, astronomical time switch control device with power on-off and manual override. Time clock shall be able to be programmed for a minimum of 2 independent schedules for any days of the week, in addition to being able to skip selected days. Unless otherwise noted, time clock shall have minimum 2 single-pole, double-throw normally open contacts shall be rated at not less than 20 amperes at 277-volt, AC. Time clock shall have a non-volatile memory that requires no backup. Time clock for the parking lot lighting control station shall have 3 single pole, double throw normally open contacts.

Pilot Light, PL: Pilot light shall be panel mounted, heavy duty, oil tight indicating light with 277-volt, AC, LED lamp with green domed cap.

Parking Lot Lighting Control Station: Parking lot lighting control station shall consist of a factory assembled control station consisting of lighting contactors, time clock, pilot lights, bypass timer switches and terminal block.

Photoelectric Cell Unit PEC: Photoelectric cell unit shall be cadmium sulfide photoelectric control with capacity of 1000-watt incandescent or 1800-watt inductive or fluorescent load, mounting adapter, and EEI-NEMA twist lock receptacle; Fisher-Pierce, Ripley, or equal.

Terminal Block, TB: Terminal block shall be 30-ampere, 600-volt, molded plastic with two or more mounting holes and two or more terminals in each cast block. The molded plastic shall have a high resistance to heat, moisture, mechanical shock, and electrical potential and shall have a smooth even finish. Each block shall have a molded marking strip attached with screws. Terminal blocks shall have tubular, high pressure clamp connectors.

FABRICATION

Daylight Control System: Daylight control system shall be an open loop system consisting of a daylight control station, a remotely mounted photoelectric unit and a bypass pushbutton station.

Outside light control systems shall include a remotely mounted photoelectric cell unit.

Parking lot lighting control system shall include a remotely mounted photoelectric cell unit.

Component Mounting:

Selector switches, pilot lights and bypass timer switches shall be mounted on the hinged doors of lighting control stations. Unless otherwise noted, all other components shall be mounted on the back panel.

PART 3 - EXECUTION

Occupancy Sensors:

Occupancy sensors shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location. Contractor shall provide all supports, hangers, spacers, channels, fasteners and all other necessary hardware to support the sensors. Final location of sensors shall be per manufacturer's recommendations to provide best coverage for the application. All power packs and auxiliary relay packs shall be mounted inside an appropriately sized junction boxes or NEMA Type 1 enclosures. All splices or connections shall be made inside the junction box or enclosure. Ceiling mounted occupancy sensors shall be mounted in the ceiling with a flat unobtrusive appearance.

Lighting Fixtures:

Lighting fixtures shall be mounted securely in accordance with the manufacturer's recommendations. Mounting methods shall be suitable for the particular type of ceiling or support at each location.

The Contractor shall provide all supports, hangers, spacers, channels, fasteners and other hardware necessary to support the fixtures.

Fixtures shall be set at the mounting heights shown on the plans, except heights shown shall be adjusted to meet conditions.

Ballasts:

All fluorescent fixtures shall be equipped with high power factor ballasts suitable for the line voltage and for the type, size and number of lamps required by fixture. The Contractor has the option to install low voltage dimming control provided that the Contractor submit plans and specifications with appropriate revisions for the low voltage dimming control to the Engineers for approval prior to installation.

All ballasts used in unheated areas inside the building shall be 0°F ballasts or less.

Control Stations: Daylight control station, lighting control station outside light control stations and parking lot lighting control station shall be mounted in the IFS behind openable compartment doors.

12-16.08 FIRE ALARM AND DETECTION SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational fire alarm and complete detection system in accordance with the details shown of the plans and these special provisions.

The system shall include all materials, whether mentioned or not, but are necessary for the complete and operational fire alarm and detection system.

Related Work:

Basic materials shall be as specified in Section 12-16 "Basic Materials And Methods" of these Special Provisions.

Duct mounted smoke detectors shall be as specified in "Heating, Ventilating And Air Conditioning Equipment And Systems " in Section 12-15, "Mechanical" of the Special Provisions.

SYSTEM DESCRIPTION

Design Requirements:

The fire alarm and detection system shall be a low voltage, direct current, zoned, closed circuit, electrically supervised, and Class A addressable fire alarm and detection system including voice communication. The system shall consist of fire alarm control panel, manual pull stations, smoke detectors, duct smoke detectors, heat detectors, end-of-line resistors, audio-visual devices, speakers, remote microphones, annunciator and all other necessary appurtenances.

When a device is activated in a specific zone, the fire alarm control panel shall communicate with the fire alarm interface panel, specified elsewhere in these special provisions, to shut off all the heating, ventilating and air conditioning system within that zone. Fire alarm system shall provide relays or contacts for the immediate shutdown of air conditioning units upon detection of the fire or smoke. The voltage rating of the control panel and ampere rating of the auxiliary switching relays shall be as required for the particular application.

Each and all items of the fire alarm and detection system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by UL or FM, and shall bear the "UL" or "FM" label. Control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing will not be acceptable. The alarm system components shall be listed by the California State Fire Marshal.

SUBMITTALS

Product Data:

Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include brand name and catalog reference of equipment supplied, wiring diagrams, battery calculations, voltage drop calculations, riser diagrams and floor plans showing all devices and conduit and conductor sizes.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall include building floor plan with component layout and wiring layout, including conduit size and wire sizes. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification. Fire Matrix Table shall be submitted.

Test Reports: Submit results of electrical continuity, insulation, and ground continuity tests performed on installed wiring.

QUALITY ASSURANCE

Regulatory Requirements:

Submittals shall be sent to the State Fire Marshall for review and stamping prior to sending them to the Department of Transportation. Submittals shall be approved by both the Engineer and the State Fire Marshall prior to commencing work.

Allow 12 weeks for the State Fire Marshall's review process. This time is in addition to the time allotted the State for submittal review in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions. Submittals to the State Fire Marshall will be considered as part of the lump sum payment and no additional monies will be paid.

PART 2 - PRODUCTS

Fire Alarm and Detection System:

The system shall be wired, connected, and left in first-class operating condition. The system shall be electrically supervised, 4-wire Class A system, and shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision.

The system shall be an addressable fire alarm system complete with built-in or portable reprogramming capabilities so that all reprogramming or reconfiguration of the fire alarm system can be accomplished without removal of any solid-state devices. Hardware, software, and passwords used in programming the system and the I/O Map shall be submitted to the Engineer.

The system alarm operation subsequent to the alarm activation of any manual station, automatic Detection device, or sprinkler flow switch shall be as follows:

1. The appropriate initiating device circuit’s red LED shall flash on the control panel and the annunciator until the alarm has been silenced at the control panel or the annunciator. Once silenced, this same LED shall latch on. A subsequent alarm received after silencing shall flash the subsequent zone alarm LED on the control panel.
2. A pulsing alarm tone shall occur within the control panel until silenced.

3. All alarm-indicating appliances shall sound in a Continuous Ringing Alarm pattern or Designated State Code pattern until silenced by the Alarm Silence Switch at the control panel or the annunciator.
4. All visual alarm lamps shall operate in a continuous pattern until extinguished by the Alarm Reset Switch.
5. Activate a supervised signal to notify District 08 Operations Control Center or other specified notifying parties.

The alarm indicating appliances may be silenced by authorized personnel upon entering the locked control panel and operating the Alarm Silence Switch or by use of the key operated switch at the annunciator. A subsequent zone alarm shall reactivate the signals.

The system shall include the following electrical power requirements:

1. The control panel shall receive 120 V ac power via a dedicated standby circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 V ac power in a normal supervisory mode in accordance with NFPA 72. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 80 percent capacity in 12 hours.
3. The supervised standby battery power shall operate the entire system for 4 hours under normal conditions. At the end of 4 hours, the standby battery shall power the system under fire alarm conditions for 5 minutes.
4. All circuits requiring system-operating power shall be 24-Volt DC and shall be individually fused at the control panel.
5. Faults on ancillary circuits shall not interfere with the operation of the alarm and detection system.

Activation of Standpipe or Sprinkler Tamper Switch and Trouble Silence Switch:

1. The activation of any standpipe or sprinkler tamper switch shall activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper" LED at the system control panel and the annunciator. There shall be no confusion between valve tamper activation and opens and grounds on fire alarm initiation circuit wiring.
2. Activating the Trouble Silence Switch will silence the supervisory audible signal while maintaining the Sprinkler Supervisory Tamper LED indicating the tamper contact is still activated.
3. Restoring the valve to the normal position shall cause the audible signal and LED to pulse at a March Time Rate.
4. Activating the Trouble Silence Switch will silence the supervisory audible signal and restore the system to normal.

Fire Alarm Control Panel:

Fire alarm control panel shall be surface-mounted, locking cabinet, completely self-contained control panel suitable for 120-volt, AC, input power with separate terminals for all external wires and end-of-line resistors installed within the control panel. Panel be capable of communicating with addressable devices, annunciator panel and the fire alarm interface panel. When a device is activated, the panel shall display the zone where the device is located and the zone number shown on the contract plans.

Each addressable device shall have a unique address. The manufacturer shall program each address to a system input zone and correlate to output operations as indicated. Non-functioning, non-addressed and non-programmed devices shall report trouble. Provide for site modification to the addressable programming. Provide for removal of devices without the necessity of readdressing any other devices.

Provide installation flexibility by ensuring that the physical sequence (placement) of the devices on the loop need not determine the device address. Installation tables shall be furnished to identify all device addresses.

The control panel shall conform to the following requirements:

Compatible with Simplex 4100; Radionics 6000 or 6500 receiver or equivalent;
9 zones expandable to 16 zones;
Digital dialer communicator;
Audible trouble signal, silencing switch and trouble pilot light;

Solid state, modular construction;
Fan shut down relays;
24-hour standby batteries, battery charger with automatic transfer on loss of utility company power and retransfer upon restitution of utility power;
Indicating lights for normal power failure, battery power failure, audible alarm, and silencing switch;
Low battery reporting.

Manual Pull Station: Manual pull station shall be single-action, addressable, closed circuit, pull down type pull station mounted on a standard electrical outlet box. The manual pull station actuating contact shall function continuously until reset. The pull station shall have provisions for fire drill and testing. Manual pull station shall be capable of being reset with the same key as for the Fire Alarm Control Panel. By using the key, authorized personnel can activate the manual pull station. Finish the station in red with white lettered instructions, which shall read: "Local Alarm - Does Not Alert Fire Department."

Smoke Detector: Smoke detector shall be addressable and ionization type detector with dual chamber with sensitivity control and plug-in detector head. One chamber shall be for detection and the other for changes in ambient parameters. The smoke detector shall have integral LED light to indicate operation of the smoke detector.

Heat Detector: Heat detector for automatic detection of fire shall be addressable compact and rugged construction employing rate-of-rise and fixed temperature methods of detecting fires. The heat detectors shall have twist-and-lock type plug-in detector head, and low profile.

Audio-visual Device: Audio-visual device shall be addressable, vibrating type horn with flashing light and adjustable volume control with maximum audible output of 90 dB at 10 feet from the horn. Frequency of audio visual flash shall be not less than one flash per second.

Annunciator: Annunciator shall be an 80-character annunciator that is supplied with the fire alarm control panel. Annunciator shall be capable of communicating with the fire alarm control panel to display the same message displayed by the fire alarm panel.

Speaker: Speaker shall consist a thermoplastic injection molded acoustic panel and a 4-inch treated paper cone speaker. The acoustic panel shall be an impact resistant and flame retardant thermoplastic. Speaker shall be compatible with the fire alarm control panel that is provided and shall be equipped with a matching transformer with multiple taps. Speaker shall be designed for mounting in a 4-inch square box.

Remote Microphone: Remote microphone shall be a microphone that is compatible with the fire alarm control panel annunciation system.

Fire Alarm Interface Panel: Fire alarm interface panel shall include control relays required to communicate with the direct digital controller of the heating,ventilatiting and air conditioning equipment. The voltage rating and ampere rating of the control relays shall be as required for the particular application.

PART 3 - EXECUTION

INSTALLATION

The fire alarm system shall be installed in accordance with the manufacturer's recommendations. No modification of the recommended alarm system type, components type, or replacement shall be made without prior written approval from the Engineer.

Fire alarm panel zoning: Fire alarm panel zoning shall be as follows:

Zone 1: SRLAB - Lab A(Columns A thru G)-Laboratory Areas
Zone 2: SRLAB – Lab A(columns A thru G) –Office Areas and Restrooms
Zone 3: SRLAB - Lab B (Columns J thru K-Laboratory Areas
Zone 4: SRLAB _Lab B (Columns J thru K) – Office Areas

Zone 5: SRLAB - Lab C (Columns M thru R)-Laboratory Areas
Zone 6: SRLAB _Lab C (Columns Mthru R)-Office Areas and Restrooms
Zone 7: SRLAB - Hallways
Zone 8: SRLAB - Administration (Columns S thru AA)
Zone 9: SRLAB - Long Term Storage (Columns BB thru DD)

Conduit and Conductors:

Conduit size shall be as recommended by the fire alarm system manufacturers except that conduits shall be not less than ½-inch diameter, trade size and shall not be filled more than 40%.

Conductors and cables for the fire alarm system including cables for speakers, remote microphones and annunciators shall be as recommended by the fire alarm system manufacturer.

Conduits shall be concealed in ceiling or walls within the offices, lobbies, conference rooms, multi-purpose room, below 10 feet-8 inches in hallways with open ceilings and all rooms with ceiling height furred walls,

No common wires shall be connected to components across multiple Zones. Each individual Zone may have common wiring between components in that specific Zone.

No wiring other than that directly associated with fire alarm detection, alarm, or auxiliary functions shall be permitted in fire alarm conduits. Wiring splices shall be avoided to the extent possible and if needed, they shall be made only in junction boxes and shall be connected with crimp-type connectors. Wire nut-type connections are not acceptable.

Transposing or changing color-coding of wires will not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end with wire markers. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls and function switches shall be clearly labeled on all equipment panels.

All wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is 10 MΩ as checked by a Megger after all conduit, conductors, and detector bases have been installed, but before the detector devices are plugged into the based or end-of-line devices installed.

All conduits entering or leaving the terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner. A number shall be used only once.

All conductors shall be tagged, labeled, and color-coded. Color-coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire.

Wire shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be professionally manufactured wire-markers. Each group of wires shall be tagged with its destination at each panel, terminal box, or junction box.

Speakers shall be flush mounted in areas with concealed conduits.

FIELD QUALITY CONTROL

Testing:

The operational test for the fire alarm and detection system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 working days in advance of performing the operational tests.

The completed fire alarm system shall be fully tested in accordance with NFPA 72 under the observation of the Engineer and subject to approval by the Local Fire Marshal. Submit test procedures before performing tests. Testing program shall include the following information, listings, and instructions:

1. Statement of procedure objective, scope of test, and list of equipment/system to be tested.
2. List of equipment required setting up and performing the tests.
3. List of prerequisite tests that need to be completed before the procedure can be performed.
4. Description of the required procedure setup, including diagrams illustrating test equipment connections and identifying test points, where applicable.
5. Step-by-step instructions for performing the procedure, identifying the points where data is to be recorded and the limits for acceptable data.
6. Provisions for recording pertinent test conditions and environment at time of test.
7. Instructions for recording data on data sheets and verifying that procedure steps have been completed.

Monitoring:

The contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION

Training: The Contractor shall provide one hour of on-site training on the use, operation, and, maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

Training shall include:

Classroom-type training, giving course participants an understanding of the overall system and its operation.

Hands-on training, giving course participants actual trouble-shooting and maintenance experience. This shall include training in user-level programming of the Fire Alarm Control Panel and annunciator to perform routine maintenance tasks such as deleting a device or zone, or reprogramming the Fire Alarm Control Panel to recognize a substitute or replacement device.

Provide professionally prepared training manuals to supplement the Operation and Maintenance Manuals and submit them to the Engineer for review and approval at least two months prior to the start of classroom instruction. The training manuals shall be prepared specifically for use as training aids for the specific system.

Each course participant shall receive copies of the Operation and Maintenance Manuals, training manuals, and other pertinent material prior to the commencement of training sessions.

Upon completion of each course, instructor's manuals, Operation and Maintenance Manuals, training manuals, and training aids shall become the property of the State.

Throughout the Contract and guaranty period, it shall be the responsibility of the Contractor to supply the State with all changes and revisions to the training manuals and other documentation.

The State reserves the right to copy all training materials and aids for use in the District conducted training courses.

The Contractor shall provide all special tools, equipment, training aids, and any other materials required to train course participants. The number of special tools and other training equipment shall be adequate for the number of participants attending the course.

The State shall have the right to videotape any and all training courses presented by the Contractor. The State shall also have the right to use these videotapes to train State personnel in the future.

12-16.09 INTRUSION ALARM SYSTEM

PART 1 - GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational intrusion alarm system, including access control supervision, in accordance with the details shown on the plans and these special provisions.

The system shall include all materials, whether mentioned or not, that are necessary for a complete and operational intrusion alarm system.

Related Work:

Basic materials shall be as specified in "Basic Materials And Methods" in Section 12-16, "Electrical" of these Special Provisions.

Attention is directed to the requirements specified under “Finish Hardware” in Section 12-8, “Finish Hardware,” regarding door hardware equipment connected to the electrical system.

Attention is directed to the requirements specified under site work for the motorized gate operator connected to the gate digital card reader unit.

SYSTEM DESCRIPTION

Design Requirements:

The intrusion alarm system shall be an access control and an intrusion alarm system. The system shall low voltage, direct current, and individually zoned. Each zone shall be "supervised, Class B circuit." The intrusion alarm system shall consist of an intrusion alarm control panel, access control panel, access control terminal and printer, security hardware, card readers and accessories, keypads and accessories, and DC power supply and standby battery systems. The end of line resistor shall be installed in the control panel.

Each and all items of the alarm system shall be listed as a product of a single alarm system manufacturer under the appropriate category by UL or FM, and shall bear the "UL" or "FM" label. Control equipment shall be listed under UL category AHJ as a single alarm unit for commercial use. Partial listing will not be acceptable.

The alarm system shall self-test and report status of individual zones every twenty-four (24) hours.

SUBMITTALS

Product Data:

Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Installation instructions shall include manufacturer and catalog reference, and model number of equipment to be furnished, conduit and conductor sizes, wiring diagram, system riser diagram, standby battery calculations, interconnections between intrusion and access control system.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall include building floor plan with component layout and wiring layout, including conduit size and wire sizes. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification.

Test Reports: Submit results of electrical continuity, insulation, and ground continuity tests performed on installed wiring.

QUALITY ASSURANCE

Installer Qualification: The installer of the intrusion alarm system shall be licensed by the State Department of Consumer Affairs, Bureau of Collection and Investigative Services. License numbers and expiration dates shall be included on all correspondence.

Manufacturer Qualifications: The server manufacturer shall have not less than five (5) years experience in products or systems similar to the size and complexity indicated for this project and with a record of successful in-service performance.

PART 2 - PRODUCTS

INTRUSION ALARM SYSTEM

The intrusion alarm system shall consist of two nominal systems: an access control system and an intrusion alarm system. The two systems shall be interconnected as one system.

Both systems shall be wired, connected, and left in first-class operating condition. Both systems shall be electrically supervised, 4-wire Class B system, and shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision.

Both systems shall be an addressable system complete with built-in or portable reprogramming capabilities so that all reprogramming or reconfiguration of the system can be accomplished without removal of any solid-state devices. Hardware, software, and passwords used in programming the system and the I/O Map shall be submitted to the Engineer.

The digital keypads shall be installed to manually alarm or disarm either the alarm intrusion or access systems during normal State business hours.

The systems shall include the following electrical power requirements:

1. The control panels shall receive 120-volt AC power via dedicated standby circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120-volt AC power in a normal supervisory mode in accordance with NFPA 72. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate to provide a minimum of 80 percent capacity in 12 hours.
3. The supervised standby battery power shall operate the entire system for 24 hours under normal conditions.
4. All circuits requiring system-operating power shall be 24-Volt DC and shall be individually fused at the control panel.
5. Faults on ancillary circuits shall not interfere with the operation of the alarm and detection system.

COMPONENTS

Intrusion Alarm Control Panel:

The intrusion alarm control panel shall be a surface-mounted, locking enclosure, completely self-contained suitable for 120-volt, AC, input power with separate terminals for all external wires. Panel shall be UL listed for commercial use and capable of remote control identification.

The control panel shall have front accessible controls, LCD display and indication digital keypad. The system shall test line voltage every twenty-four (24) hours System shall connected to RJ31X or RJ38X telephone jack or equivalent. System shall have silent alarm signaling.

The intrusion alarm control panel shall meet the following requirements:

Compatible with Radionics D9412G or equivalent;
Minimum 90 zones;
Digital dialer communicator;
Capable of controlling up to 8 access entry doors by providing entry/exit to authorized users. Authority shall be assigned by the control panel.
Capable of reporting intrusion and access control devices to a remote monitoring site.
Capable of providing identification, annunciation and communication of alarmed detectors by point and each access control by number.
Capable of segregating the points into separate independent areas.
Capable of expansion using hard-wires address identification modules.
Capable of sending manually or automatically test and status reports.
Capable of being programmed locally or remotely via a portable computer or a computer running the remote programming software.
Capable of annunciating alarm, trouble, service reminders and other relevant system status messages.
Capable of executing diagnostics and testing functions locally or remotely.
Capable of controlling relays and automatically executing system functions based upon time/event scheduling software.

Software shall be an application that is routinely advertised and supplied for access control and intrusion alarm monitoring by the access control panel manufacturer. The software shall be capable of integrating with Radionics D9412G or equal. The software shall include hour, day of week and day of month based and shall be capable of executing the following functions:

Alarm/disarm any specific zone.
Bypass/Unbypass a point.
Activate/Deactivate all relays.
Send a report to monitoring station and access control terminal.
Automatically adjust system clock for daylight savings time.
Turn an access authority level on/off.
Hold any door open (unlocked and shunted) for an unlimited time.
Secure any or all doors closed (locked, no valid cards will allow entry).
Return a door to normal operation (locked, valid cards will allow entry).
Turn recording of access grant events on/off.
Turn recording of access denied events on/off.

Access Control Panel:

The access control panel shall be a surface-mounted, locking cabinet, completely self-contained suitable for 120-volt, AC, input power with separate terminals for all external wires. Panel shall be UL listed for commercial use and shall be compatible with the intrusion alarm control panel.

The control panel shall have front accessible controls, LCD display and indication digital keypad. The system shall test line voltage every twenty-four (24) hours System shall connected to RJ31X or RJ38X telephone jack or equivalent. System shall have silent alarm signaling.

The access control panel shall meet the following requirements:

Compatible with Radionics D9412G or equivalent;
Capable of supporting up to 800 addressable devices. Use twisted pairs shielded solid wire for addressable loops.
Capable of controlling up to 120 access entry doors by providing entry/exit to authorized users by the area into which door enters;
Capable of monitoring designated access doors state;
Capable of reporting unauthorized entries via the intrusion alarm panel to a remote monitoring site;
Capable of providing identification, annunciation and communication of alarmed monitoring site;
Capable of segregating the points into separate independent areas;
Capable of sending manually or automatically test and status reports;

Capable of being programmed locally or remotely via portable computer or a computer running the remote programming software;
Capable of annunciation alarm, trouble service reminders and other relevant system status messages;
Capable of executing relays and automatically executing system functions based upon time/event scheduling program. The program can be hour, day or week or day of month based and shall be capable of executing the following functions:

Send a report
Adjust system clock for daylight savings time
Hold a door open (unlocked and shunted)
Secure a door closed (locked, no valid cards will allow entry)
Return a door to normal operation (locked, valid cards will allow entry)
Turn recording of access grant evens on/off
Turn recording of access denied events on/off

Access Control Terminal and Printer:

Access control terminal shall be a premanufactured tower style server with accessories. Control terminal shall have all the software needed to run the control terminal and the access control system. In addition the original DVD or CD copy of the access control system software and manuals, inclusive of all licenses, shall be handed over to the Engineer.

The access control terminal and printer shall meet the following requirements:

Processor	2.66GHz minimum: Quad-Core or Opteron 64
Memory	4GB fully Buffered DIMMs (ECC FBD) 533/667MHZ
Hard Drive	3.5" SATA 300, 7200 RPM, 750GB
Operating System	Microsoft Windows Small Business Server 2003 Premium Editions
Graphics Card	PCI Express, 512 MB
Ethernet Connection	Internal, gigabyte
Modem	V.92 internal
DVD Drive	16X DVD+/-RW Drive
PCI Expansion Slots	Minimum six PCI expandable slots
Power Supply	930W with hot-plug redundant power
Keyboard, Mouse	USB, standard keyboard with USB port and optical mouse
Printer	Multifunction Laser with 128MB memeory
Monitor	24-inch Widescreen LCD, 5 ms response, min 1000:1 Contrast
UPS	1500VA, 120-volt AC, 6 plug surge protection

Magnetic Contact Switch:

Magnetic door switch for pedestrian door shall be a 2-section, self-lock mounting type switch, and shall be compatible with the material of the door on which it is installed. The switch shall be epoxied in the switch housing. Magnetic contact switches shall be the type capable of being concealed on the top of the doorframe.

Magnetic contact switches for the overhead vehicle doors shall be 2-section, extra heavy-duty, floor mounting type switch with stainless steel armored cable.

Switch shall be housed in a non-magnetic case.

Glass Break Discriminator: Glass break discriminator shall be an acoustic glass break detector with advanced technology for sensing and reporting sound and shock wave activity. Detector shall respond to energy of breaking windows using piezo-electric crystal microphone. Sensor coverage pattern shall be directional, detecting breakage of uncovered glass in a 34-foot wide area at a distance of 11½ feet minimum. The sensor shall be housed in a fire retardant ABS housing.

Digital Keypad: Digital keypad shall be weatherproof, vandal resistant, surface mounted, 12-button keypad with minimum 120 individual user code capability. Digital keypad shall have alarmed and ready lights and audible warning signal.

Keypad shall have programmable ability of 1-6 digit user codes, EEPROM memory for backup of all codes, a relock time delay adjustable time from either 1 to 90 seconds or on/off, and a tamper switch to detect unauthorized access to the keypad working mechanism. The keypad shall be low voltage, 12-volt DC or 24-volt DC and have four (4) on-board relays for electric door locks and strikes, alarm shunting, forced door and door ajar monitoring.

Building Access Digital Card Readers: Digital card reader shall be vandal resistant, weatherproof, with stainless steel housing filled with epoxy resin. Building access digital card readers shall use dual technology low profile reader. Card reader shall be compatible with the access control system and application software.

Entry Gate Digital Card Readers: Gate digital card reader shall be vandal resistant, weatherproof, with stainless steel housing filled with epoxy resin. Entry gate digital card readers shall use dual technology low profile reader. Digital gate card reader shall be compatible with the access control system and application that as shown on the plans.

Access Card Reader Controller:

Access card reader controller shall be a solid state controller designed to interface between the access control panel and the digital card readers. Controller shall have a minimum of input and output terminals for the digital card readers, magnetic contact switches, electric door strikes, electromagnetic door locks, digital keypads, DC power input and output, auxiliary contacts and data output contacts for communication with the intrusion alarm control panel. Access card reader controller shall be compatible with the access control system and application software.

Access card readers controllers enclosure shall be a surface mounted NEMA Type 1 hinged door enclosure sized suitably to enclose all card reader controllers and power supply system and shall include 2 normally closed contacts for cabinet tampering and power failure status.

Power supply for the access card reader controllers shall include battery charger and batteries. Battery charger shall be suitable for 120-volt AC input. The charger shall be adequately sized for the number of batteries required and DC output of the battery charger shall match the DC input rating of the card reader controllers and storage batteries. Storage batteries shall be nickel-cadmium, dry type storage batteries with DC output voltage rating to suit the card reader controller. Storage batteries shall be adequately sized for the power outage specified in these special provisions..

Premise Entrance Cards: Premise entrance cards shall be credit card type plastic material and shall be supplied with the card readers.

Electric Door Strike: Electric door strike shall be Von Duprin 6000 Series, Folger Adams Co. 732-75 Series or equal.

Electromagnetic Door Locks: Electromagnetic door locks shall be an electromagnetic locking device capable of at least 1800 pounds force and suitable for outdoor use. Electromagnetic lock shall be Securitron Magnalock Series; Schlage Magforce Series; or equal.

PART 3 - EXECUTION

INSTALLATION

The intrusion alarm system shall be installed in accordance with the manufacturer's recommendations. All wires from all devices shall be brought back to the control panels and then terminated inside the appropriate control panel. All wires entering or leaving the control panels shall be terminated at the terminal blocks. Terminal block jumpers shall be factory made jumpers. Use of wire nuts shall be prohibited. Field mounted devices or expansion modules at the bottom or side of the control panel shall not be allowed.

The access control system shall be installed in accordance with the manufacturer's recommendations. Access control terminal and printer shall be installed and completely wired in place at the location shown on the plans. Access control panel and accessories controllers shall be installed at locations as shown on the plans. All wires from all devices shall be brought back to the control panels and then terminated inside the appropriate control panel. All wires entering or leaving the control panels shall be terminated at the terminal blocks. Terminal block jumpers shall be factory made jumpers. Use of wire nuts shall be prohibited. Field mounted devices or expansion modules at the bottom or side of the control panel shall not be allowed.

Digital card readers shall be installed at switch height at locations shown on the plans and in accordance with the manufacturer's recommendations. The entry gate digital card reader shall be mounted on a standard goose neck type support. Any driver sitting in their vehicle shall be able to use the premise card on the card reader without exiting the vehicle.

Contractor shall provide 100 pre-programmed premise entrance cards to the Engineer prior to system startup.

The magnetic door switch section without wires shall be recessed flush into the top edge of the pedestrian door at the approximate center of the door, and the switch section with wires shall be recessed flush in the top section of the doorframe. The two sections of the switch shall be mounted directly opposite each other to provide maximum sensitivity. The wiring from each magnetic switch shall be run to the control panel in the zone dedicated for the intrusion alarm circuit.

The magnetic door switch section mounted on the bottom edge of the overhead door shall be without wires. The switch section with wire shall be mounted on the floor directly below the switch part without wires. Magnetic contact switches for overhead doors shall be mounted.

The glass break discriminator shall be mounted on the ceiling at locations shown on the plans.

Intrusion alarm zoning: Intrusion alarm panel zoning shall be as shown on the plans.
Conduit and Conductors:

Conduit size shall be as recommended by the intrusion alarm manufacturer, except that conduits shall be not less than ½-inch diameter. Conduits shall be concealed in ceiling or wallsoffices, lobbies, conference rooms, multi-purpose room, below 10'-8" in hallways with open ceilings and all rooms and hallways with ceiling height furred walls. . All other conduit shall be exposed.

All conductors and cables for the intrusion alarm system wiring shall be as recommended by the intrusion alarm system manufacturer. All conductors and cables for the access system wiring shall be as recommended by the access system manufacturer.

No common wires shall be connected to components across multiple Zones. Each individual Zone may have common wiring between components in that specific Zone.

No wiring other than that directly associated with detection, alarm, or auxiliary functions shall be permitted in these conduits. Wiring splices shall be avoided to the extent possible and if needed, they shall be made only in junction boxes and shall be connected with crimp-type connectors. Wire nut-type connections are not acceptable.

Transposing or changing color-coding of wires will not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end with wire markers. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded. All controls and function switches shall be clearly labeled on all equipment panels.

All wiring shall be checked and tested to ensure that there are no grounds, opens, or shorts. The minimum allowable resistance between any two conductors or between conductors and ground is 10 MΩ as checked by a Megger after all conduit, conductors, and detector bases have been installed, but before the detector devices are plugged into the based or end-of-line devices installed.

All conduits entering or leaving the terminal cabinets and junction boxes shall be numbered in a logical and consecutive manner. A number shall be used only once.

All conductors shall be tagged, labeled, and color-coded. Color-coding shall be by wire insulation, not taping or banding. The numbering and color-coding shall be continuous for each circuit wire.

Wire shall be numbered at each connection, termination, and junction point. Wire numbering tags shall be professionally manufactured wire-markers. Each group of wires shall be tagged with its destination at each panel, terminal box, or junction box.

FIELD QUALITY CONTROL

Testing:

The operational test for the intrusion alarm and access control system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and demonstrate system stability under normal vibration and shocks to components. The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing the operational tests.

Testing program shall include the following information, listings, and instructions:

1. Statement of procedure objective, scope of test, and list of equipment/system to be tested.
2. List of equipment required setting up and performing the tests.
3. List of prerequisite tests that need to be completed before the procedure can be performed.
4. Description of the required procedure setup, including diagrams illustrating test equipment connections and identifying test points, where applicable.
5. Step-by-step instructions for performing the procedure, identifying the points where data is to be recorded and the limits for acceptable data.
6. Provisions for recording pertinent test conditions and environment at time of test.
7. Instructions for recording data on data sheets and verifying that procedure steps have been completed.

Monitoring:

The contractor shall provide monitoring services for the facility for one year after the acceptance of the contract. The services shall include a toll-free telephone line connecting to the 24-hour on call monitoring station. Monitoring station shall contact designated site representative in the event of alarm and dispatch an immediate on-site response to the alarm location if the site representative cannot be reached or verification of the cause of the alarm cannot be determined.

Monitoring services after the first year will be handled by the State.

DEMONSTRATION

Training: The Contractor shall provide one hour of on-site training on the use, operation, and maintenance of the system for not more than 8 designated State employees. The Contractor shall notify the Engineer in writing not less than 10 days in advance of proposed training class.

Training shall include:

Classroom-type training, giving course participants an understanding of the overall system and its operation.

Hands-on training, giving course participants actual trouble-shooting and maintenance experience. This shall include training in user-level programming of the Control Panels to perform routine maintenance tasks such as deleting a device or zone, or reprogramming the Control Panels to recognize a substitute or replacement device.

Provide professionally prepared training manuals to supplement the Operation and Maintenance Manuals and submit them to the Engineer for review and approval at least two months prior to the start of classroom instruction. The training manuals shall be prepared specifically for use as training aids for the specific system.

Each course participant shall receive copies of the Operation and Maintenance Manuals, training manuals, and other pertinent material prior to the commencement of training sessions.

Upon completion of each course, instructor's manuals, Operation and Maintenance Manuals, training manuals, and training aids shall become the property of the State.

Throughout the Contract and guaranty period, it shall be the responsibility of the Contractor to supply the State with all changes and revisions to the training manuals and other documentation.

The State reserves the right to copy all training materials and aids for use in the District conducted training courses.

The Contractor shall provide all special tools, equipment, training aids, and any other materials required to train course participants. The number of special tools and other training equipment shall be adequate for the number of participants attending the course.

The State shall have the right to videotape any and all training courses presented by the Contractor. The State shall also have the right to use these videotapes to train State personnel in the future.

12-16.10 COMMUNICATION SYSTEM

PART 1 – GENERAL

SUMMARY

Scope: This work shall consist of furnishing and installing a complete and operational communication system in accordance with the details shown of the plans and these special provisions.

Related Work:

Plywood backing panels for mounting communication equipment shall conform to the requirements specified under "Finish Carpentry," in Section 12-6 "Woods and Plastics" of these special provisions.

Basic electrical materials, including wire identification and Anchorage devices, shall be as specified under "Basic Materials and Methods," in Section 12-16 "Electrical," of these special provisions..

SYSTEM DESCRIPTION

The communication system shall include a telephone system and a data system as shown on the plans and specified in these special provisions. The system shall include fiber optic and unshielded twisted pairs and terminations as shown on the plans and specified herein.

The systems shall include all materials, whether mentioned or not, but are necessary for the complete and operational communication system.

SUBMITTALS

Product Data: Manufacturer's descriptive information and installation instructions shall be submitted for approval.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall include building floor plan with component layout and wiring layout, including conduit size and wire sizes. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification.

QUALITY ASSURANCE

The sub-contractor or installer selected to provide the installation of the communication system shall be certified by the manufacturing company in all aspects of design, installation and testing products described herein and shall have a minimum of five (5) years experience on similar structured cabling systems (SCS). Sub-contractor or installer shall possess a valid C-10 or C-7, "General Communications Cabling License", issued by the State of California, Department of Consumers Affairs, Sate Contractor's License Board. Evidence of the license is required as part of the submittal.

The subcontractor or installer selected must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize authorized manufacturer components.

CLOSEOUT SUBMITTAL

Documentation of all cables shall be included in the field installation. It shall include the destination of each cable leaving the terminal board area. Documentation shall be provided in triplicate and considered baseline readings. One copy of the documentation shall be left at the focal point of the cabling system, two copies to the Engineer.
Every punchdown block shall be clearly labeled.
A list of cross-connection shall be kept in the communication closet or room. The list shall be enclosed in plastic.

PART 2 – PRODUCTS

Telephone terminal boards, TTB/MDF, TTB/IDF and RTB: Telephone terminal boards shall be ¾-inchthick A-C exterior grade veneer plywood. Unless otherwise shown on the plans, telephone terminal board dimensions shall be 8 feet by 8 feet.

Punchdown Blocks: Punchdown blocks for telephone or voice cables shall be high density Type 110, Level 6 punchdown blocks. Quantity of punchdown blocks per terminal board shall be suitable for all the cables that are shown terminated on the terminal plus at least 10 percent room for future expansion. Punchdown blocks shall be type 100 copper termination blocks and shall support category 6E applications and shall facilitate cross connection and interconnection using either cross connect wire (voice only) or patch cords. The punchdown blocks shall be fire retartdant, molded plastic consisting of horizontal strips for terminating 25 pairs of conductors each. The punchdown block shall be able to accommodate 24 AWG cable conductors and shall be UL listed.

Modular patch panel: Modular patch panels shall be provided for data cables. Modular patch panels shall be approved for Category 6E data cables.

Communication Outlet Box: Communication outlet boxes shall be not less than 100 mm square box complete with cover plates and modular type communication outlet jacks. Cover plates shall be provided with tear resistant icons showing a computer icon for data outlets and telephone icon for voice jacks.
Communication Outlet Jack: Communication outlet jacks shall be combination of data or voice jacks. Unless otherwise noted on the plans each communication outlet shall include 3 data jacks and one voice jack. Data jack shall be modular termination device for Category 6E cable and shall snap into CAT 6E face plates and/or CAT 6E termination boxes. Data jack shall allow punch down termination of 4 pairs of 22-24 AWG, UTP cables on the back of the Jack and a male RJ-45 connector on the front. Data jack shall be UL approved, fit 568B applications and meet or exceed TIA/EIA CAT 6E specification to support 1000 Base-T & Gigabit Ethernet system applications. Data jacks shall be blue in color. Voice jacks shall be similar to data jacks except it shall be ivory in color.

Communication cables: Communication cables shall be data cables or telephone cables. Data cables and telephone cables shall be Category 6E, 4 pair, 24 AWG, unshielded twisted pair (UTP), low loss, extended frequency data cable and shall conform to TIA/EIA 568B Commercial Telecommunications Building Standards, Horizontal Cable Section and be part of UL ® Law Certifications and Follow-up program. Application standards supported should include but not limited to IEEE802.3, Ibase5, 10BASE-T; IEEE 802.5, 4 Mbps (328 ft, 104 workstations and TP-PMD. In addition, these cables shall be capable of supporting evolving high-end applications such as 100 base-T and 52/155 Mbps ATM and shall meet or exceed the electrical and mechanical specifications listed below. Data cables shall be blue and telephone cables shall be white.

DC resistance: 28.6Ω /1000 ft, maximum
DC resistance Unbalance: 5 per cent, maximum
Mutual capacitance @ 1 kHz: 14 pf/1000ft
Capacitance unbalance(pair to ground): 400 pF/1000ft
Characteristic impedance: 100Ω +/- 15 Ω from 1 to 100 Mhz

Fiber optic cables: Fiber optic cable shall be multi-mode, graded index fibers with 62.5 micron cores. Number of strand shall be as shown on the plans. Fibers must comply with EIA/TIA 492 specifications and IS 11801 standards. Fibers shall have dual wavelength capability; transmitting at 850 and 1300 nm ranges. All fibers shall be color coded to facilitate individual fiber identification. Fibers shall have D-LUX coating or approved equivalent to ensure color retention, minimize microbending losses and improve handling. The coating shall be mechanically strippable. Fiber optic cable shall be suitable for outside plant applications.

Fiber Characteristics Table	
Core	62.5 µm +/- 3 µm
Core Non-Circularity	< 6 per cent
Core/cladding Concentricity Error	< 3.0 µm
Numerical Aperture	0.275 +/- 0.015
Cladding Diameter	125 µm +/- 1 µm
Cladding Non-circularity	≤2.0 per cent
Colored Fiber Diameter	250 µm +/- 15 µm
Buffering Diameter	890 µm +/- 50 µm
Minimum Tensile Strength	250 µm +/- 15 µm
Fiber Minimum Bending Radius	0.75 in
Cable Minimum Bending Radius During Installation After Installation	100 000 psi 20 times cable diameter 10 times cable diameter
Operating Temperature Range	32 °F to 149 °F
StorageTemperature Range	-40 °F to 149 °F
Maximum Fiber Loss: At 850 NM At 1300 NM	 3.4 dB/ km (typical range 2.8 to 3.4 dB/km) 1.0 dB/ km (typical range 0.5 to 1.0 dB/km)
Minimum Bandwidth:	200 MHz at 850 NM 500 MHz at 1300 NM

Fiber Patch Panel: Fiber patch panel shall be provided for terminating the fiber optic cables. The patch panel shall provide cross-connect, interconnect and splicing capabilities and include support hardware to properly terminated and ground the fiber optic cables. The patch panel shall have connector panels that snap into the side of the module and accommodated ST, FDDI, SMA, FC, D4 or SC connectors. The patch panel shall be of lightweight polycarbonate and shall have lockable hasp for security. The patch panel shall be UL approved. Manufacturer of the patch panel shall be ISO 9001 certified.

Fiber Optic Connectors: Fiber optic connectors shall be field installable and shall be capable of mounting 0.9 mm buffered fiber or on 3.0 mm cordage. Connectors shall utilize a PC polishing on the tip to provide high yield during installation and meet EIA and IEC standards for repeatability. Connectors shall have a locking feature to coupler and assure non-optical disconnect. Connectors shall be from the same manufacturer as the fiber optic cable.

Telephone Panels: Telephone panel, type 1 shall be a surface mounted NEMA Type 1 enclosure with a hinged door and shall be 24 inches wide by 24 inches high by 6 inches deep. Telephone panels, type 2 shall be a flush mounted NEMA Type 1 enclosure with a flush hinged door and shall be 18 inches wide by 24 inches high by 4 inches deep. Both types of telephone panels shall have flush locks on the door trims and with wooden backboards.

TESTING

Fiber optic cables shall be factory tested prior to shipping.

PART 3 – EXECUTION

INSTALLATION

The system shall be installed at locations as shown on the plans and by methods recommended by the manufacturer.

The Contractor shall provide all supports, fasteners and other hardware necessary to support the units.

Data system shall conform to the guidelines of TIA/EIA TSB36 and the cable manufacturer recommendations.

Punchdown block for data cable shall be on the right side of the terminal board and punchdown blocks for telephone cables shall be on the left hand side of the terminal board.

Data and telephone cables shall be extended continuous and unspliced between the associated punchdown blocks and shall be terminated on the 8-pin modular jacks provided in each outlet. Unless otherwise noted, each communication outlet shall have 4 runs with no splices. Cable 1 shall go to position 1 in the faceplate and shall be white and designated as “telephone” cable. Cable 2 thru 4 shall be blue and shall be designated as “data cables”.

Fiber optic cables shown shall be continuous with no splices as shown on the plans. The 24 strand cable shall be run from the MDF/Phone Room to the IDF Room. The 12 strand fiber optic cable shall be run from the IDF Room in the SRLAB up to the IDF Room in the IA Building. Splices are not allowed in between the rooms.

All cables and terminations shall be identified at all locations. All cables shall be terminated in alphanumeric sequence at all terminations

FIELD QUALITY CONTROL

The operational test for the communication system shall be performed by the Contractor in the presence of the Engineer. The operational tests shall demonstrate that all functions of the system operate in the manner described in the manufacturer's literature and that the system is stable under normal vibration and shocks to components. All the copper communication cables shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage. Voice and data horizontal wiring shall be tested from the outlet to the closet termination.

Category 6E cables shall be tested for conformance to the specifications of EIA/TIA 568 B Category 6E.

Testing shall be done with a TIA/TIA TSB-67 UL Certified Level 2 test set. Test shall be include length, mutual capacitance, characteristic impedance, attenuation, and near-end and far end cross talk. Any pairs not meeting the requirements of the standard shall be brought into compliance by the Contractor, at the Contractor’s expense. Complete, end to end test results must be submitted to the Engineer.

All fiber testing shall be performed on all fibers in the completed end to end system. Testing shall consist of a bidirectional end to end Optical Time Domain Reflectometer (OTDR) trace performed per EIA/TIA 455-61 or a bidirectional end to end power meter test performed per EIA/TIA 455-53A. The system loss measurements shall be provided at 850 and 1310 nanometers. Testing of fiber optic cables shall include the following:

Testing after delivery to the project site but prior to installation.

Testing after installation but prior to connection to any other portion of the system.

Attenuation deviations from the shipping records of greater that five percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval.

After the fiber optic cable has been pulled, but before breakout and termination, all fibers shall be tested with an OTDR for attenuation. Fiber optic cables shall be tested at 850 and 1310 nanometer. Attenuation readings shall be recorded for each direction.

Test results shall be all recorded, dated, compared and filed with the previous tests. Copies of traces and results shall be submitted to the Engineer. If the OTDR tests results are unsatisfactory, the fiber optic cable shall be unacceptable and shall be replaced at the Contractor’s expense.

The Contractor shall notify the Engineer in writing not less than 10 days in advance of performing these operational tests.

12-16.11 STANDBY GENERATOR

PART 1 - GENERAL

Scope: This work shall consist of furnishing and installing a standby generator in accordance with the details shown on the plans and these special provisions.

Related Work:

Basic materials shall be as specified in Section 12-16 "Basic Materials And Methods" of these special provisions.

Sheet metal Ductwork shall be as specified in “Heating, Ventilating and Air Conditioning Equipment and Systems”, in Section 12-15, “Mechanical” of these special provisions.

SYSTEM DESCRIPTION

The standby generator shall be factory assembled and shall include such other miscellaneous accessories, not mentioned, which are required for the proper operation of the standby generator.

The standby generator assembly shall be supplied with drip pan, warning sign, battery hydrometer with storage container, battery filler, distilled water, anchoring devices, and vibration isolators which are required for the complete installation.

PERMIT REQUIREMENTS

The Contractor shall make all arrangements and obtain all permits and licenses required for the operation of the standby generator to this project. Upon written request by the Contractor the State will pay all permits and licenses. Such request shall be submitted no less than 45 days before operation is required. Full compensation for any costs incurred by the Contractor to obtain permits and licenses shall be considered as included in the contract lump sum price for the building work and no additional compensation will be allowed therefore.

SUBMITTAL

Product Data:

A list of materials and equipment to be installed and the manufacturer's descriptive data shall be submitted for approval. Any other data as requested by the Engineer shall also be submitted for approval.

Manufacturer's descriptive data shall include complete description, performance data and installation instructions for the materials and equipment specified herein. Engine and generator control schematic diagrams, interconnection diagrams, and exact dimension drawings of the engine-generator set shall be submitted for approval. All control and power conductors on the diagrams shall be identified with wire numbers.

Working Drawings: Working drawings shall be submitted for approval. Working drawings shall show the shape, size, and method of attachment for each component used in the work. Submit control and wiring diagrams that shall include rough-in dimensions, component layout and wire number identification.

Closeout Submittals: Prior to the completion of the contract, 3 identified copies of the operation and maintenance instructions with part lists for all the equipment specified herein shall be delivered to the Engineer at the job site. Three instruction and part list shall be in a bound manual and shall be complete for the equipment installed. Incomplete material will be returned for correction.

QUALITY ASSURANCE

The control panel and its components shall comply with all applicable NEMA standards.

PART 2 – PRODUCTS

MANUFACTURED ITEMS

Standby Generator: The standby generator shall consist of an engine, exhaust system, starting batteries, battery charger, weatherproof protective housing, generator, standby generator control panel, and automatic transfer switch.

COMPONENTS

Engine:

The engine shall be 4-cycle, turbocharged, natural gas fuel type with not less than 519 cubic inches of piston displacement, liquid cooled, and designed for continuous operation. The engine shall deliver a minimum of 300 horsepower at 1800 RPM.

The engine shall operate satisfactorily on natural gas –l fuel. The crankshaft shall be drilled for full pressure lubrication to all bearings. All crankshaft bearing surfaces shall be hardened. The crankshaft shall have one more main bearing than there are number of cylinders. The intake and exhaust valves and valve seats shall be heat resistant alloy steel. The exposed surfaces of the engine shall be finished with one coat of primer and 2 coats of an industrial paint suitable for the intended use.

The engine shall be equipped with the following accessories:

Oil Filter System: The pressurized lubricating oil system shall have a full flow filter system, consisting of a strainer with openings not to exceed 0.025 inch in greatest dimension, and a separate, cleanable or replaceable filter capable of removing particles of 25 microns and larger.

Air Filter System: The air intake shall be provided with a dry type air filter of adequate capacity to effectively remove dirt and abrasives from the combustion air. The dry type filter shall be designed to allow for easy removal and replacement of filter element. The filter shall be equipped with service indicators to indicate necessary replacement.

Engine Governor: The governor shall be an electronic throttle type providing a 0.25 percent speed regulation from no load to full load and provide +/-0.25 percent steady state frequency regulation.

Engine Cooling: The engine shall be equipped with an engine driven radiator cooling system. The radiator shall be capable of cooling the engine while operating at 100 percent rated continuous load in 125°F maximum ambient temperature. Fan shall be push type.

Engine Preheater: The engine shall be equipped with a 120 volt, 1000 watt electric water jacket heater supplied and preinstalled by the standby generator manufacturer. The heater shall be thermostatically controlled to maintain engine coolant at the proper temperature to meet the manufacturer's start up requirement–. The required electrical wiring shall be factory installed. Controls shall be provided to shut down the engine pre-heater during start-up and while the standby generator is running.

Engine Starter: The engine shall be provided with a 12-volt heavy duty positive engagement solenoid shift starting motor. The drive mechanism for engaging the starting motor with the engine flywheel shall engage and release without binding.

Safety Controls: The engine shall be provided with automatic controls that shut down engine operation when low lubricating oil pressure, high water temperature or overspeed conditions occur. The values at which the low lubricating oil pressure, high jacket water temperature and overspeed controls operate to shut down engine operation, shall be as recommended by the engine manufacturer.

Overcrank safety controls shall be provided as specified in these special provisions.

Exhaust System:

The exhaust system shall consist of a silencer and flexible connection.

The silencer shall be a critical type, sized to meet or exceed the engine requirements. The silencer shall be provided with a drain, flange connection and companion flanges.

The flexible connection shall be bellows type, not less than 12 inches in length and installed between the engine exhaust and the Schedule 40 galvanized steel exhaust pipe. The flexible connection shall be constructed of Type 321 stainless steel and shall be provided with flanged ends for connection to the engine and galvanized steel exhaust pipe.

Starting Batteries: Storage batteries for engine starting and other requirements shall be sufficient in number, and shall be 6-cell, heavy duty, lead-acid type. Total battery capacity shall be a minimum of 90 ampere-hours at the 20-hour rate. Batteries shall be mounted in corrosion resistant battery racks located within the skid base and shall be provided with battery cables of sufficient length to connect to the DC apparatus.

Battery Charger:

The battery charger shall be of the three stage type and shall be mounted in the engine-generator control panel. The battery charger shall be provided with the following features:

1. Dual fusing for AC input and DC output.
2. Automatic DC voltage regulation.
3. Automatic load regulation.
4. DC cranking circuit disconnect relay.

Generator:

The generator shall be a brushless type, single bearing,-with a drip-proof enclosure. The insulation shall be NEMA Class H or better.

The generator shall be rated at 180 kW, 225 KVA, 0.8 power factor, 480/277 volts, 3-phase, 4-wire, 60 Hz, and 1800 RPM. The generator shall have the following capabilities:

1. Steady state voltage regulation at full rated load shall be within plus or minus 0.5 percent.
2. Voltage regulation shall be within plus or minus 2 percent of rated steady state voltage from no load to full load.
3. Voltage recovery shall be within 2 percent of nominal rated voltage within 5 seconds, after the rated load is applied or removed in one-step.

Standby Generator Control Panel:

A completely wired and assembled engine-generator control panel shall be mounted on the engine-generator unit. The panel and its components shall comply with NEMA standard: NEMA ICS 1 "Industrial Controls and Systems", and shall be fully enclosed and vibration isolated. The panel shall include the following switches and instruments exposed on the front of the control panel:

1. AC ammeter.
2. AC voltmeter.
3. Three-position combination ammeter-voltmeter-phase selector switch.
4. Frequency meter.
5. Manual reset generator exciter circuit breaker with thermal magnetic trips.
6. Battery charger DC ammeter.
7. Manual "START-STOP" switch.
8. Indicating lights to show cause of emergency shutdown.
9. Emergency "STOP" switch.
10. Voltage adjust rheostat.
11. Engine oil pressure gage.

12. Engine running time meter.
13. Engine water temperature gage.
14. One SPDT contact for remote monitoring of all engine-generator failures.
15. One SPDT contact for remote monitoring of engine-generator running status.

Equipment mounted in the engine-generator control panel shall be arranged for easy service access. Equipment or devices to be mounted within the engine-generator control panel shall include the following:

1. Battery charger.
2. Automatic voltage regulator.
3. Automatic starting controls.
4. Radio interference suppression
5. Transformers, relays and other equipment required for proper operation.

Overcranking Protection: Upon failure of primary power, the engine shall be automatically cranked for 20 seconds or until it starts, whichever is shorter. If the engine fails to start, within 20 seconds, further attempts to start shall be prevented by a manually reset lockout device. Overcranking default condition shall be indicated by a pilot light.

Automatic Transfer Switch:

The automatic transfer switch shall be a 480/277-volt, 3-phase, 4-wire, microprocessor based, electrically operated, mechanically held device utilizing two 3-pole molded case switches. The transfer switch shall have an interrupting rating of 65,000 AIC at 480 volts. Transfer switch shall be UL-1008 listed. The microprocessor based logic controller shall be door mounted and shall provide the operator with an overview of the transfer switch status, parameters and diagnostic data.

Transfer switch shall be rated at not less than 300 amperes continuous duty, and shall be electrically and mechanically interlocked to positively prevent simultaneous connection of both normal and standby power sources. Electrical operation shall not permit a neutral position between normal and standby power sources.

Voltage sensing relays shall monitor each phase of the normal power source, and shall initiate the sequence for transfer at the factory preset limit of 70 percent of the rated voltage on any phase. Retransfer to the normal power source shall be delayed for a period adjustable from 0 to 30 minutes, initially set at 5 minutes.

Momentary power outages shall be ignored by delaying cranking of the standby power plant for a period adjustable from 0.2 to 120 seconds, initially set at 60 seconds.

Connection of the standby load shall be prevented until the standby power plant reaches at least 90 percent of its operating voltage.

Retransfer from the stand-by power plant to the normal power source shall be delayed for a period adjustable from 0 to 30 minutes, initially set at 5 minutes.

Shutdown of the standby power plant after retransfer to the normal power source shall be delayed for a period adjustable from 2 to 10 minutes, initially set at 5 minutes.

An additional SPDT auxiliary switch operated by the transfer switch shall be provided on each side of the transfer switch to operate future peripheral equipment. A programmable plant exerciser clock to exercise the engine-generator shall be provided. Plant exercise shall be adjustable 7 day interval and be able to run the generator at no load.

The automatic transfer switch, including the special features specified herein, shall be integrated inside the integrated facilites switchboard . A 3-position "HAND-CRANK"-"OFF"-"AUTO" selector switch shall be mounted in the front panel.

Miscellaneous Accessories:

Drip Pan: A drip pan fabricated of not less than 20-gage galvanized sheet steel with turned up edges rolled over wire, sized to catch all oil or grease which may drop from the engine, shall be provided under the engine-generator set.

Ductwork: A galvanized sheet metal duct shall be fabricated and installed between the radiator and the exhaust louvers. This radiator cooling air exhaust duct shall be installed with vibration isolators.

Generator Main Power Disconnect: The generator main power disconnect shall be 600-volt, 3-pole, 300-ampere trip molded case, thermal-magnetic, circuit breaker and shall be mounted in a NEMA Type 1 enclosure on the side of the generator housing. The adjustable magnetic trip shall be set for 1500 amperes. The interrupting capacity of the circuit breaker shall be not less than 60,000 amperes at 480 volts AC.

Warning Sign: A warning sign shall be mounted at a location on the engine generator set approved by the Engineer. The sign shall be sheet steel, not less than 18-gage with a baked enamel coating. The sign shall have a red background and white letters not less than 2 inches in height. The sign inscription shall read as follows:

DANGER
AUTOMATIC
MAY START AT ANY TIME

Battery Accessories: A commercial quality battery hydrometer with plastic type storage container, and a commercial quality one-gallon battery filler with filler hose and one gallon of distilled water, shall be furnished and installed adjacent to the battery location. The body of the battery filler shall be clearly marked "DISTILLED WATER" in letters not less than ½ inch in height.

FABRICATION

The standby generator assembly shall be factory assembled and mounted on a steel channel base with vibration isolators.

PART 3 – EXECUTION

The engine-generator set shall be installed on a concrete slab as shown on the plans.

Anchoring devices shall be as recommended by the engine-generator manufacturer and shall be installed to fasten the engine-generator set securely to the concrete slab.

Vibration isolators shall be installed between the engine base and the concrete slab. The type and size of the isolators shall be as recommended by the engine-generator manufacturer.

The warning sign shall be mounted on the standby generator set in a location facing direction of travel.

TESTING

The engine-generator power generating system, including transfer switch, shall be tested at completion of installation and adjustments.

All necessary materials, test equipment and recording instruments, and labor required for the tests shall be furnished. The Contractor shall notify the Engineer not less than 5 working days in advance of testing. Testing shall be performed in the presence of the Engineer.

The engine-generator power generating system shall be tested for compliance with the conditions shown on the plans and the requirements specified in these special provisions.

Tests shall utilize a resistive load bank supplied by the Contractor.. All transient requirements shall be demonstrated by means of recording instruments. All engine safety shutdown devices shall be demonstrated.

A battery and starter test shall consist of 30 seconds of continuous cold with out engine start, followed by immediately by a normal engine start without excessive starter laboring.

A 4-hour heat run shall be conducted at 100 percent of generator rated full load capacity at the specified rated voltage.