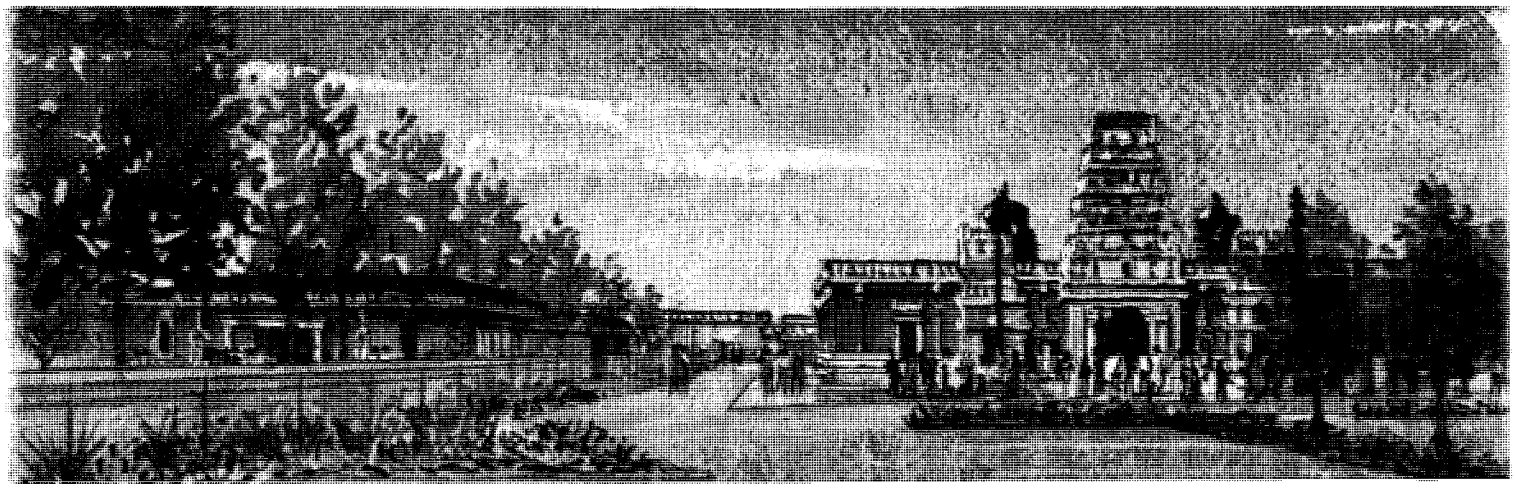
Hindu Community and Cultural Center Building D



HINDU COMMUNITY

AND

CULTURAL CENTER

Building D

PROJECT MANUAL

FOR

PROPOSED BUILDING D

HINDU COMMUNITY AND CULTURAL CENTER

1200 Arrowhead Avenue
Livermore, CA 94551

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December 2011

DOCUMENT 00010

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DIVISION 1 GENERAL REQUIREMENTS

DIVISION 2 TO DIVISION 10

Refer to Drawing Sheets for specifications.

DIVISION 11 EQUIPMENT

Not used.

DIVISION 12 FURNISHINGS

Not used.

DIVISION 13 SPECIAL CONSTRUCTION

Not used.

DIVISION 14 CONVEYING SYSTEMS

Not used.

DIVISION 15 MECHANICAL

Specifications on Drawings.

DIVISION 16 ELECTRICAL

Specifications on Drawings.

END OF DOCUMENT

DOCUMENT 00011

BID BREAKDOWN FORM BUILDING "D"

Bid Breakdown:

Description	Sub Contractor	Amount
Site Work		
Concrete		
Structural & Misc. Steel		
Rough Carpentry		
Finish Carpentry		
Granite tops & shwr. surrounds		
Roofing		
Flashing & sheet metal		
Insulation		
Caulking & Sealants		
Windows		
Glass & Glazing		
Door, Frames & Hardware		
Modernfold DORMA Paired Panel Systems: Acousti-Seal 942		
Lath & Plaster		
Drywall Assemblies		
Acoustical Ceiling		
Paint		
Ceramic tile		
Specialties		
Toilet Accessories		
HVAC		
Fire Sprinkler System		
Plumbing		
Electrical		
Fire Alarm		
Signage		
	Subtotal:	
General Conditions		
General Liability Insurance		
G. Contractor's Fee, Overhead & Profit _____%		
Performance Bond		
	Total Contract Amount:	

DOCUMENT 00700

GENERAL CONDITIONS

1 GENERAL CONDITIONS

A. The General Conditions of the Contract for Construction, AIA Document A201, 2007 Edition, is a part of this Contract, and is incorporated herein as fully as if here set forth.

END OF DOCUMENT

DOCUMENT 00800

SUPPLEMENTARY CONDITIONS

1.1 REFERENCE TO DIVISION 1 - GENERAL REQUIREMENTS

A. Where provisions of General Conditions relate to Project administration or work-related requirements of the Contract, those paragraphs are expanded in Division 1 - General Requirements of the Specifications.

B. General Conditions, Supplementary Conditions and Division 1 - General Requirements contain information necessary for completion of every part of Project.

1. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.2 SUPPLEMENTS

A. The following supplements modify, change, delete from or add to General Conditions of the Contract as indicated in Section 00700 - General Conditions.

B. Where any part of the General Conditions is modified or deleted by these supplements, unaltered provisions of the modified article, paragraph, subparagraph or clause shall remain in effect.

C. General: The Term "Architect" used throughout the AIA A201 shall refer to the Project Engineer of Record (hereinafter "EOR").

ARTICLE 1: CONTRACT DOCUMENTS

ADD to 1.1 the following definitions:

1.1.8 **Approved**: The terms approved, directed, selected, required, ordered, designated, accepted, acceptable and satisfactory shall require written action by EOR.

1.1.9 **Equal, or Approved Equal:** The terms equal or approved equal shall require requests for substitutions for products or manufacturers not specified; requests for substitutions shall be in accordance with requirements of Section 01630 - Product Substitution Procedures.

1.1.10 **Furnish:** The term furnish means supply and deliver to Project, unless otherwise defined in greater detail.

1.1.11 **Install:** The term install is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use.

1.1.12 **Provide:** The term provide means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

ARTICLE 2: OWNER

DELETE Subparagraph 2.2.5 in its entirety and substitute the following:

2.2.5 **Copies of Contract Documents:** Contractor will be furnished a reasonable number of copies of Drawings and Project Manuals, along with a reproducible set of Drawings.

ARTICLE 3: CONTRACTOR

ADD the following to Subparagraph 3.4.2:

3.4.2.1 **Substitutions:** After Contract has been executed, the Owner and EOR will consider formal requests for substitution of products in place of those specified only under conditions set forth in Section 01630 - Product Substitution Procedures.

ARTICLE 5: SUBCONTRACTS

ADD the following to Paragraph 5.3:

5.3.2 **Materials Suppliers:** For purposes of this Contract materials suppliers shall be considered a Subcontractor regardless of whether or not they perform their portion of the Work at the site. Do not agree that material suppliers should be considered as Subcontractors.

ARTICLE 9: PAYMENTS AND COMPLETION

ADD the following to 9.3.2.

9.3.2.1 **Stored Materials:** Payments for materials stored off-site will be made, subject to Owner's approval, if Contractor provides invoice, lien release, certificate of insurance covering stored materials, and stores material in approved, bonded warehouse. Such payments should be limited to no more than 75% of each invoice.

ARTICLE 11: INSURANCE AND BONDS

ADD the following to Subparagraph 11.1.2:

11.1.2.1 **Insurance Amounts:** Amount of insurance shall be as approved by Owner. When additional insurance is required, Owner reserves right to negotiate difference in cost directly with Contractor's Insurance Carrier. Insurance requirement amounts must be listed herein if not listed elsewhere.

ADD the following to 11.1.3:

11.1.3.1 **Certificate of Insurance:** Furnish one copy of each Certificate of Insurance required for each copy of Agreement. Owner should be listed as insured.

11.1.3.1.1 Form of certificate shall be an approved certificate which specifically sets forth evidence of all coverage required.

11.1.3.1.2 Furnish to Owner copies of any endorsements subsequently issued amending coverage or limits.

11.1.3.2 Upon receipt of any notice of cancellation or alteration, Contractor shall, within five days, procure other policies of insurance similar in all respects to policy or policies about to be canceled or altered.

11.1.3.2.1 If Contractor fails to provide acceptable policies of insurance, Owner may obtain such insurance at cost and expense of Contractor.

END OF DOCUMENT

EXHIBIT 'A'-
SHEET INDEX

ALL DRAWINGS DATED: 10-28-11

ARCHITECTURAL DRAWINGS

CO	COVER SHEET
T-1	TITLE SHEET
A-0.1	LEED NC CHECKLIST
A-1.0	SITE PLAN
A-1.1	FLOOR PLAN, NOTES & DETAIL
A-1.2	REFLECTED CEILING PLAN & DETAILS
A-1.3	ROOF PLAN & DETAIL
A-1.3A	SECURITY ORDINANCE
A-2.1	ELEVATIONS
A-2.2	BUILDING SECTIONS, INTERIOR FINISH SCHEDULE & DETAILS
A-3.1	ENLARGED FLOOR PLAN, INTERIOR ELEVATIONS & DETAILS
A-4.1	ACCESSIBLE DETAILS
A-4.2	DOOR & WINDOW SCHEDULE, NOTES & DETAILS
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STRUCTURAL DRAWINGS

S-1	FLOOR FOUNDATION PLAN
S-2	FLOOR FRAMING PLAN
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SD-2	DETAIL SHEET
SD-3	FRAMING DETAILS

ELECTRICAL DRAWINGS

E-0.0	ELECTRICAL LEGEND, DRAWING INDEX, SCHEDULES
E-0.1	DIAGRAMS & SCHEDULES
E-0.2	ELECTRICAL SITE PLAN
E-1.1	POWER & SIGNAL PLAN
E-1.2	LIGHTING PLAN
E-1.3	ELECTRICAL ROOF PLAN
E-2.1	SPECIFICATIONS

MECHANICAL DRAWINGS

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M-13.0	MECHANICAL PLAN
M-14.0	MECHANICAL ROOF PLAN
M-15.0	DETAILS

PLUMBING DRAWINGS

P-10.0D	PLUMBING LEGEND & GENERAL NOTES
P-10.1D	PLUMBING SCHEDULES
P-11.1D	PLUMBING RISER DIAGRAMS
P-11.2D	PLUMBING SPECIFICATIONS
P-13.0D	PLUMBING PLAN
P-13.01D	PLUMBING ENLARGED PLAN
P-14.0D	PLUMBING ROOF PLAN
P-15.0D	PLUMBING DETAILS

ENERGY COMPLIANCE

T-24.1	TITLE 24 COMPLIANCE FORMS
T-24.2	TITLE 24 COMPLIANCE FORMS
T-24.3	TITLE 24 COMPLIANCE FORMS
T-24.4	TITLE 24 COMPLIANCE FORMS
T-24.5	TITLE 24 COMPLIANCE FORMS

SECTION 01110

SCOPE OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Project involves construction of site walkways connected to Building "D", construction of Building "D" including entry covered walkway to be connected to existing covered walkway structure in the south lot of the Hindu Community and Cultural Center, 1200 Arrowhead Avenue, Livermore, California, 94551.

1. Hazardous Materials Removal: Known hazardous materials will be removed under separate contract (NIC); inform Owner immediately where materials suspected of being hazardous are encountered.

2. Owner reserves right to remove and retain possession of existing items prior to start of Contract.

3. All Utilities connections to Building "D" part of this contract.

4. All work from transformer to Building "D" included in this contract.

1.2 REQUIREMENTS INCLUDED

A. This section includes administrative provisions:

1. Work sequence.
2. Contractor use of premises.
3. Building occupancy.
4. Lines and levels.
5. Regulatory requirements and reference standards.

1.3 WORK SEQUENCE

A. Coordinate construction schedule and operations with the EOR.

1. Construction work to accommodate the north and south lot existing buildings in operation and both the lots being used for parking during construction period and in particular on weekends and special events.

2. Designated staging area and construction parking will be provided during weekdays.

1.4 CONTRACTOR USE OF PREMISES

A. Limit use of premises for work and construction operations to allow for:

1. Building occupancy.
2. Work by other contractors.
3. Authorized access.

4. Public access to public areas.

B. Coordinate use of premises and access to site under direction of the EOR.

1.5 LINES AND LEVELS

A. Establish lines and levels by use of recognized engineering practices.

1.6 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS

A. Regulatory Requirements:

1. EOR has reviewed design requirements of local, state and federal agencies for applicability to Project.

2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.

B. Reference Standards:

1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.

2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

END OF SECTION

SECTION 01300

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes general procedural requirements for ongoing submittals.

B. Related Requirements:

1. Section 01630: Product substitution request procedures. There must be a time limit stated for cut-off of all substitutions and a statement requiring that the Contractor is to be responsible for all costs and no delays will be forthcoming relative to substitutions. This has no bearing on products found to no longer be available, etc.
2. Section 01770: Closeout requirements including Project Record Documents.

1.2 PROCEDURES

A. Submittals: Transmit each item under form acceptable to EOR.

1. Identify Project, Contractor, subcontractor, major supplier.

a. Date and attach sequential identification number for each new submittal.

b. Identify each resubmittal using original submittal number and sequential identification clearly indicating item is resubmitted.

2. Identify pertinent Drawing sheet and detail number, and Specification section number as appropriate.

3. Identify deviations from Contract Documents.

4. Provide space for Contractor and EOR review stamps.

5. Contractor: Review and stamp submittals from subcontractors prior to submitting to EOR. Review submittals and indicate where conflicts occur with Contract Documents and with work of other subcontractors.

B. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.

C. After EOR review of submittal, revise and resubmit as required, identify changes made since previous submittal.

D. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit construction progress schedule with separate item for each major trade and operation, identifying first day of each week.

B. Progress Schedule Format: Horizontal bar chart as approved. This form of scheduling is OK, but not much compatible with a Schedule of Values.

1.4 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 or another approved 8-1/2" by 11" paper format; Contractor's standard media-driven printout will be considered on request. Submit within 15 days after award of Contract.

B. Format: Table of Contents of this Project Manual, identify each line item with number and title of major Specification sections.

1.5 SHOP DRAWINGS

A. Submit three reproducible prints; minimum sheet size 8-1/2" by 11". All Shop Drawings shall be accompanied by a licensed stamp of the submitter. No substantial changes to the Contract Plans and Specs will be allowed.

B. After review, reproduce and distribute.

1.6 PRODUCT DATA/MANUFACTURERS' LITERATURE

A. Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

B. Include manufacturers' installation instructions only when required by Specifications or specifically requested by EOR.

1. Maintain copy of manufacturer installation instructions and recommendations in Contractor's field office for review.

C. Submit number of copies Contractor requires, plus one copy to be retained by EOR.

1.7 SAMPLES

A. Submit full range of manufacturers' standard colors, textures, and patterns for EOR's selection.

B. Submit samples to illustrate functional characteristics of Product, with integral parts and attachment devices.

C. Coordinate submittal of different categories for interfacing work.

D. Include identification on each sample, giving full information.

E. Submit number of samples required by Contractor plus one to be retained by EOR.

1. Maintain one set of approved samples at Project Field Office.

F. Sizes: Provide following sizes unless otherwise specified.

1. Flat or Sheet Products: Minimum 6" square, maximum 12" by 12".
2. Linear Products: Minimum 6", maximum 12" long.
3. Bulk Products: Minimum one pint, maximum one gallon.

G. Full size samples may be used in the Work upon approval.

1.8 MANUFACTURERS' CERTIFICATES

A. Submit certificates, in duplicate in accordance with requirements of each Specification section.

END OF SECTION

SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Description of Project management and coordination.

B. Related Sections:

1. Section 01300: Administrative requirements.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Specifications sections to ensure efficient and orderly installation of each part of Work.

1. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

2. Coordinate work to assure efficient and orderly sequence of installation of construction elements.

3. Make provisions for accommodating items installed by Owner or under separate contracts.

B. Prepare memoranda for distribution to each party involved as needed, outlining special procedures required for coordination.

1. Include required notices, reports, and list of attendees at meetings; include EOR in distribution.

C. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.

1. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated; coordinate locations of fixtures and outlets with finish elements.

E. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other construction activities and activities of other contractors to avoid conflicts and ensure orderly progress of Work.

1.3 PROJECT MEETINGS

A. Schedule and administer Project meetings throughout progress of Work:

1. Pre-construction meeting.
2. Progress meetings at weekly intervals.
3. Pre-installation conferences.
4. Coordination meetings.
5. Special meetings.

B. Weekly meetings will be held at existing Building B, prepare agenda with copies for participants, preside at meetings, record minutes and distribute copies within two days to EOR, participants, and those affected.

C. Attendance: Project Manager, Job superintendent, major subcontractors and suppliers as appropriate to agenda along with EOR, reps of Temple Construction Committee and consultants

D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments, delivery schedules, submittals, requests for information, maintenance of quality standards, pending changes and substitutions, and issues needing resolution.

END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes general quality control requirements.

1.2 QUALITY CONTROL, GENERAL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of best practices and quality.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes temporary construction facilities and temporary controls.

B. Related Requirements:

1. Section 01700: Progress cleaning and final cleaning.

C. Provide temporary construction facilities and temporary controls as required to conform to applicable authorities and as required to complete Project in accordance with Contract Documents.

1. Authorities: Contact EOR to establish extent of temporary facilities and temporary controls required by authorities.

2. General Contractor: Contact EOR to establish extent of temporary facilities and temporary controls required by EOR.

1.2 ELECTRICITY AND LIGHTING

A. Provide electrical service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.

1. Contractor will pay costs of energy used from existing on-site services unless otherwise directed by EOR.

B. Provide lighting for construction operations.

1. Permanent lighting may be used during construction; maintain lighting and make routine repairs.

1.3 WATER AND SANITARY FACILITIES

A. Provide water service required for construction operations; extend branch piping with outlets located so water is available by use of hoses.

1. Connection to existing facilities is permitted unless otherwise directed by EOR.

2. Contractor will pay for water used from existing on-site services.

B. Provide and maintain required sanitary facilities and enclosures.

1. Existing facilities shall not be used unless otherwise directed by EOR.

1.4 CONSTRUCTION AIDS

A. Noise, Dust and Pollution Control: Provide materials and equipment necessary to comply with local requirements for noise, dust and pollution control.

B. Fire Protection: Maintain on-site fire protection facilities as required by applicable authorities and insurance requirements.

C. Use of Existing Facilities: Verify availability of existing facilities for construction operations with the Manager prior to beginning on-site construction.

1.5 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; recycle or dispose of off-site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.6 PROJECT IDENTIFICATION

A. Signs: Subject to approval by EOR.

1.7 FIELD STORAGE

A. Storage for Tools, Materials, and Equipment: Limit on-site storage to Project area; provide weather-tight storage, with heat and ventilation for products requiring controlled conditions.

1. Maintain adequate space for organized storage and access.

2. Provide lighting for inspection of stored materials.

1.8 SITE WASTE MANAGEMENT

A. Site Waste Management: Comply with applicable regulations for diverting Project waste from landfill; aim for waste management goal of 50% or higher.

1. Effect optimum control of solid wastes.

2. Prevent environmental pollution and damage.

B. Reports: Provide as required by applicable authorities.

C. Recycling: Implement recycling program that includes separate collection of waste materials of types as applicable to Project; recycling program to be applied by Contractors and subcontractors.

D. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

1. Clean materials contaminated prior to placing in collection containers.

2. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.

E. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Owner.

1.9 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore existing facilities used during construction to specified or original condition.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes basic product requirements governing material and equipment.

1. General product requirements.
2. Product list.
3. Quality assurance.
4. Delivery, storage, and handling.

B. Related Requirements:

1. Section 01300: Submittal of manufacturers' certificates.
2. Section 01630: Product substitution procedures.
3. Section 01770: Operation and maintenance data.

1.2 GENERAL PRODUCTS REQUIREMENTS

A. Products include material, equipment, and systems.

B. Comply with Specifications, referenced standards, and applicable codes and regulations as minimum requirements.

C. Provide new materials except as specifically allowed by Contract Documents.

D. Materials to be supplied in quantity within a Specification section shall be by one manufacturer, shall be the same, and shall be interchangeable.

E. Provide equipment and systems composed of materials from a single manufacturer except where otherwise recommended by equipment or systems manufacturer or where otherwise indicated in Contract Documents.

1.3 SUBMITTALS

A. Product List: Prior to submittal of second Request for Payment, submit to EOR complete list of major products which are proposed for installation, with name of manufacturer, trade name, and model.

1. Tabulate products by Specification number and title.

B. Substitutions: Refer to Section 01630 - Product Substitution Procedures.

1.4 QUALITY ASSURANCE

A. Comply with industry standards and applicable codes except when more restrictive tolerances or requirements indicate more rigid standards or precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Install products straight, true-to-line, and in correct relationship to adjacent materials, with hairline joints, free of rough, sharp and potentially hazardous edges.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1. Seismic Anchors: Conform to code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport products by methods to avoid product damage, deliver in undamaged condition in manufacturer's unopened containers or packaging.

B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

C. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

F. Arrange storage to provide access for inspection; periodically inspect to assure products are undamaged and are maintained under required conditions.

G. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.

H. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.

I. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.

1. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.

END OF SECTION

SECTION 01630

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.

1. Contract Amount: Base on materials and products included in Contract Documents.

a. Where listed in Contract Documents, materials and products by manufacturers not listed shall not be used without EOR's approval of Contractor's written request for substitution.

2. Purpose: Substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to conditions beyond Contractor control.

a. Owner benefits either from a Contractor proposed reduction of the Contract amount or from a reduction in Contract time based on acceptance of proposed substitution.

b. List proposed cost or time reductions on request for substitution.

c. Requests not including a proposed cost or time reduction will not be considered unless Contractor submits supporting information indicating specified materials are not available.

B. Procedures are described for requesting substitution of unlisted materials in lieu of materials named in Specifications or approved for use in addenda.

1.2 CONTRACTOR'S OPTIONS

A. Products Identified by Reference Standards: Select product meeting referenced standard for products specified only by reference standard.

B. Named Manufacturers and Named Products: Select products of any named manufacturer meeting Specifications for products specified by naming one or more products or manufacturers.

C. Substitutions for Named Manufacturers and Named Products: Submit request for substitution for products and for manufacturers not specifically named where products or manufacturers are named in Specifications.

D. "Or Equal" Clauses: Submit request for substitution for product or manufacturer not specifically named in Specifications where terms "or equal", "or approved equal", or similar references are made.

1.3 SUBSTITUTIONS

A. Prior to submittal of second Request for Payment EOR will consider formal requests for substitutions from Contractor as specified in 1.1 Summary.

1. EOR will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.

2. After payments begin, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.

B. Submit each request with sequentially numbered "Substitution Request Transmittal" acceptable to EOR; submit separate request for each product and support each request with:

1. Product identification with manufacturer's literature and samples where applicable.

2. Name and address of similar projects on which product has been used, and date of installation.

C. Submit itemized comparison of proposed substitution with product specified and list significant variations.

D. Submit data relating to changes in construction schedule.

E. Note effect of substitution on other work, products, or separate contracts.

1. Note if acceptance of substitution could require revision of Contract Documents, Drawings, details or Specifications.

F. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price.

1. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.

G. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on submittals without a formal request from Contractor.

2. They are requested directly by a subcontractor or supplier.

3. Acceptance will require substantial revision of Contract Documents.

H. Substitute products shall not be ordered without written acceptance of Owner and EOR.

I. Owner and EOR will determine acceptability of proposed substitutions and reserves right to reject proposals due to insufficient information.

1.4 CONTRACTOR'S REPRESENTATION

A. Requests constitute a representation that Contractor:

1. Has investigated proposed product and determined it meets or exceeds, in all respects, specified product.

2. Will provide same warranty or longer warranty for substitution as for specified product.

3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.

4. Waives claims for additional costs that subsequently become apparent.

5. Will pay costs of changes to Contract Documents, Drawings, details and Specifications required by accepted substitutions.

1.5 EOR'S DUTIES

A. Review Contractor's requests for substitutions with reasonable promptness.

1. EOR will recommend that accept or reject substitution request.

2. Upon request, EOR will provide cost for changes to Contract Documents, Drawings, details and Specifications required for substitutions.

B. Notify Contractor in writing of decision to accept or reject requested substitution.

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes execution requirements.

B. Related Requirements:

1. Section 01500: Cleaning during construction.
2. Section 01770: Closeout procedures.

1.2 INSTALLER QUALIFICATIONS

A. Experienced Installers: Installers to have minimum five years successful experience installing items similar to those required for Project, except for individuals in training under direct supervision of experienced installer.

1.3 EXAMINATION

A. Acceptance of Conditions: Beginning installation of a product signifies installer has examined substrates, areas, and conditions for compliance with manufacturer requirements for tolerances and other conditions affecting performance.

B. Field Measurements: Take field measurements as required to fit Work properly; recheck measurements prior to installing each product.

1. Where portions of Work are to fit to other construction verify dimensions of other construction by field measurements before fabrication; allow for cutting and patching in order to avoid delaying Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

1.4 MANUFACTURERS' INSTRUCTIONS

A. Manufacturer's Recommendations: When work is specified to comply with manufacturers' recommendations or instructions, distribute copies to persons involved and maintain one set in field office.

1. Conform to requirements specified in Section 01300 for submittal of recommendations or instructions to EOR; submit to EOR only where specified or where specifically requested.

B. Perform work in accordance with details of recommendations and instructions and specified requirements.

1. Should a conflict exist between Specifications and recommendations or instructions consult with EOR.

C. Where manufacturer's information notes special recommendations in addition to installation instructions, comply with both recommendations and instructions.

1.5 INSTALLATION

A. Pre-Installation Meetings: Installers and suppliers are to attend pre-installation meetings scheduled by Contractor.

B. Comply with manufacturers written recommendations and installation instructions unless more restrictive requirements are specified.

C. Locate Work and components accurately, in correct alignment and elevation.

1. Make vertical work plumb and horizontal work level.

2. Install components to allow space for maintenance and ease of removal for replacement.

D. Install products at time and under conditions to ensure best possible results; maintain conditions required for product performance until Substantial Completion.

E. Conduct operations so no part of Work is subject to damaging operations or loading in excess of that expected during normal conditions.

F. Securely anchor permanent construction in place, accurately located and aligned with other portions of Work.

G. Allow for building movement including thermal expansion and contraction.

H. Make joints of uniform width; arrange joints as indicated, for best visual effect where not otherwise indicated; fit exposed connections together to form hairline joints except where otherwise indicated.

1.6 CLEANING

A. Cleaning During Construction: Specified in Section 01500 - Temporary Facilities and Controls.

B. Progress Cleaning: Keep installed areas clean using cleaning materials specifically recommended by manufacturers of product being cleaned; where not otherwise recommended use nontoxic materials that will not damage surfaces.

1. Remove debris from concealed spaces before enclosing space.

2. Supervise construction operations to assure no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

C. Final Cleaning: Execute final cleaning at Substantial Completion.

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

a. Vacuuming Equipment: Type with high efficiency particulate arrestor (HEPA) type filters; properly maintained.

2. Clean equipment and fixtures to a sanitary condition, clean filters of mechanical equipment, replace filters where cleaning is impractical.

3. Clean site; sweep paved areas.

4. Remove waste, surplus materials and rubbish from Project and site; recycle to maximum extent feasible.

1.7 PROTECTION

A. Protect products subject to deterioration with impervious cover. Provide ventilation to avoid condensation and trapping water.

B. Take care to use protective covering and blocking materials that do not soil, stain, or damage materials being protected.

C. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.

D. Protect interior materials from water damage; immediately remove wet materials from site to prevent growth of mold and mildew on site.

END OF SECTION

SECTION 01730

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Contractor shall be responsible for cutting, fitting and patching required to complete Work and to:

1. Make its parts fit together properly.
2. Uncover work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to Contract Documents.
5. Remove samples of installed work as required for testing.
6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

B. Related Requirements:

1. Section 01500: Temporary facilities and controls.
2. Section 01735: Selective demolition for remodeling.

1.2 SUBMITTALS

A. Submit a written request to EOR well in advance of executing cutting or alteration which affects:

1. Work of Owner or separate contractor.
2. Structural value or integrity of any element of Project.
3. Integrity of weather-exposed or moisture-resistant elements.
4. Efficiency, operational life, maintenance or safety of operational elements.
5. Visual qualities of sight-exposed elements.

B. Request shall include:

1. Identification of Project and description of affected work.
2. Necessity for cutting or alteration.
3. Effect on work of Owner or separate contractor.
4. Effect on structural integrity, or weatherproof integrity of Project.
5. Alternatives to cutting and patching.
6. Cost proposal, when applicable.
7. Written permission of separate contractor whose work will be affected.
8. Description of proposed work including:

    a. Scope of cutting, patching, alteration, or excavation.
    b. Products proposed to be used.
    c. Extent of refinishing to be included.

C. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01630 - Product Substitution Procedures.

D. Submit written notice to EOR designating date and time work will be uncovered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with Specifications and standards for each specific product involved.

B. Where Specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.

C. Provide new materials for cutting and patching unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to EOR in writing; do not proceed with work until EOR has provided further instructions.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.

B. Protect other portions of Project from damage.

3.3 PERFORMANCE

A. Execute cutting by methods that provide proper surfaces to receive installation of repairs and finishes.

B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for sight-exposed finished surfaces.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.

E. Fit work tight to pipes, sleeves, ducts, conduit and penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.

2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01735

SELECTIVE DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SUMMARY

A. Remove materials, systems, components, fixtures and equipment as designated and as required for completion of remodeling as indicated.

1. Cap and identify active utilities.

B. Related Requirements:

1. Section 01500: Site waste management requirements.
2. Section 01730: Cutting and patching.

1.2 PROTECTION

A. Do not interfere with use of adjacent building spaces; maintain free and safe passage to and from.

1. Cover and protect existing materials when demolition work is performed in areas where existing materials have not been removed.

1.3 EXISTING SERVICES

A. Disconnect or remove utility services as required for completion of Project; disconnect, stub off, and cap utility service lines not required for new construction.

1. Do not remove utilities discovered during demolition but not indicated without first determining purpose for utility coordinate with EOR and Engineers.

B. Do not disrupt services to adjacent building areas not in Project.

C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Debris: Maintain possession of materials being demolished unless otherwise noted, immediately remove from site.

B. Materials for Reinstallation: Carefully remove, store and protect materials indicated for reinstallation; where stored materials are damaged, repair to original condition or replace with new undamaged materials.

1. Immediately remove from site wet materials and materials with water stains, with mold, and with mildew.

C. Materials to be Retained by Owner: Verify extent of materials to be retained by Owner prior to beginning selective demolition. Carefully remove materials indicated to be retained by Owner; deliver and store on-site where directed by Building Manager.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolish indicated appurtenances in an orderly and careful manner.

1. Use methods that do not damage materials indicated to remain.

B. Perform demolition in accordance with authorities having jurisdiction.

C. Remove tools and equipment upon completion of work; leave area in condition acceptable to Owner and EOR.

D. Remove demolished materials from site, unless otherwise directed.

1. Remove from site, contaminated, vermin infested, and dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.

3.2 REPAIR

A. Repair damage to adjacent construction caused as result of this work.

B. Repair demolition beyond that required.

END OF SECTION

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes Contract closeout procedures.

B. Related Requirements:

1. Section 01780: Warranties.

1.2 COMPLETION

A. When Work is complete, submit written certification indicating:

1. Work has been inspected for compliance with Contract Documents.

2. Work has been completed in accordance with Contract Documents and deficiencies listed (in 'Punch List") with Certificate of Substantial Completion have been corrected.

3. Equipment and systems have been tested in presence of Owner's representative and are operational.

4. Work is complete and ready for final inspection.

B. Special Submittals: In addition to submittals required by Contract, submit following.

1. Provide submittals required by governing authorities to governing authorities with copies included in Project Record Documents.

2. Submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 PROJECT RECORD DOCUMENTS

A. Keep documents current; do not permanently conceal any work until required information has been recorded.

1. Owner will provide Contractor with a separate set of Drawings to maintain for Project Record Documents.

2. Indicate actual work on Drawings; indicate actual products used in Project Manual, including manufacturer, model number and options.

3. Update Project Record Documents daily and allow for EOR inspection at least once a month.

B. At Contract close-out submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.4 MATERIAL AND FINISH DATA

A. Provide data for primary materials and finishes.

B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

1. Electronic Format: Where available in electronic format, submit computerized compact disk (CD's) of material and finish data.

C. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:

1. Trade names, model or type numbers.
2. Cleaning instructions.
3. Product data.

1.5 OPERATION AND MAINTENANCE DATA

A. Provide data for:

1. Electrically operated items.
2. Mechanical equipment and controls.
3. Electrical equipment and controls.

B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.

D. Arrange by Specification division and gives names, addresses, and telephone numbers of subcontractors and suppliers. List:

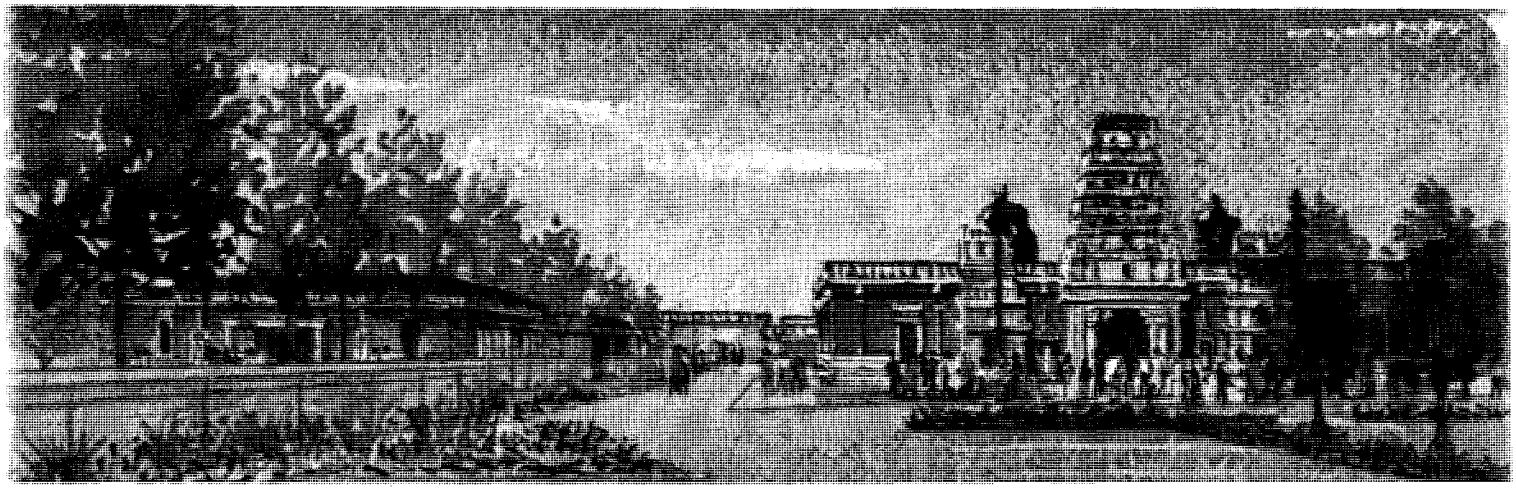
1. Appropriate design criteria.
2. List of equipment and parts lists.
3. Operating and maintenance instructions.
4. Shop drawings and product data.

E. Electronic Format: Where available in electronic format, submit computerized compact disk (CD's) of operation and maintenance data.

F. Submit all keys and other physical properties required to maintain facilities all properly tagged and identified.

END OF SECTION

Structural Calculations Building D



STRUCTURAL CALCULATIONS

LOADS

ROOF	PSF
ROOFING	3.00
SHEATHING	2.00
CEILING	4.00
RAFTERS	3.00
SPRINKLERS	3.00
MISC	5.00
TOTAL DEAD LOADS = (D.L)	20.00
LIVE LOADS = (L.L)	20.00

WALLS	EXTERIOR PSF	INTERIOR PSF
2x STUDS	1.70	1.70
SHEATHING	3.00	0.00
STUCCO	10.00	0.00
VENEER	10.00	0.00
MISC	2.30	2.3
TOTAL D.L	27.00	9.00

MATERIALS

CONCRETE ; f'_c = 2500 PSI - COMPRESSIVE STRENGTH AT 28 DAYS.

RE-BAR ; ASTM A-615 GRADE 40 OR GRADE 60 - SEE SD-1

WOOD ; DOUGLAS-FIR LARCH #2 OR BETTER.

FOUNDATION : MAT SLAB PER SOILS REPORT BY HENRY JUSTINIANO & ASSOCIATES DATED AUGUST 2009.0

ROOF FRAMING

ROOF RAFTERS SPAN = 28'-0" MAXIMUM

$W = 2(20+20) = 80^{\#}/'$; $R = \frac{80 \times 28}{2} = 1120^{\#}$; $M = \frac{80 \times 28^2}{8} = 7840^{'\#}$

$< 100^{\#}/'$ $< 1125^{\#}$ $< 12925^{'\#}$

USE 1G TJI 150 AT 24" O.C. TYPICAL

GOOD FOR $100^{\#}/'$ - TOTAL LOAD.

BEAMS AND HEADERS

BEAM SPAN = 8'-0" MAXIMUM ; $W = \left(\frac{28+8}{2}\right)(20+20) = 720^{\#}/'$ USE $750^{\#}/'$

$M = 750 \times 8^2/8 = 6000^{'\#}$; $R = \frac{750 \times 8}{2} = 3000^{\#}$ USE 6X10 #1

$R_d = 3000 - \frac{9.5}{12} \times 750^{\#} = 2406.25^{\#}$ $f_d = \frac{2406.25 \times 1.5}{52.25} = 69\ PSI$

$f_b = \frac{6000 \times 12}{82.729 \times 1.25} = 696.25\ PSI$, $\Delta = \frac{5 \times 750 \times 8^4 \times 1728}{384 \times 1.6 \times 10^6 \times 392.9} = 0.11''$, $l/\Delta = 873.25$

USE 6X10 #1 HEADERS AND BEAMS. TYPICAL

LATERAL ANALYSIS : USING CBC AND ASCE STANDARD [ASCE | SEI 7.05]

WIND : SPEED = 85 MPH - 3 SECOND GUST FACTOR & EXPOSURE "C"

SIMPLIFIED WIND PRESSURE = $PS = \lambda K_{ZL} I PS_{30} = 1.29 \times 1 \times 1 \times 14.4 = 18.5$ PSF

WHERE

λ = ADJUSTMENT FACTOR FOR BUILDING HEIGHT & EXPOSURE "C" = 1.29

K_{ZL} = TOPOGRAPHIC FACTOR = 1.0, I = IMPORTANCE FACTOR = 1.0

PS_{30} = SIMPLIFIED DESIGN WIND PRESSURE FOR EXPOSURE "B" = 14.4 PSF

SEISMIC SHEAR = $V = C_S W = 0.184 C W$, W = DEAD LOADS.

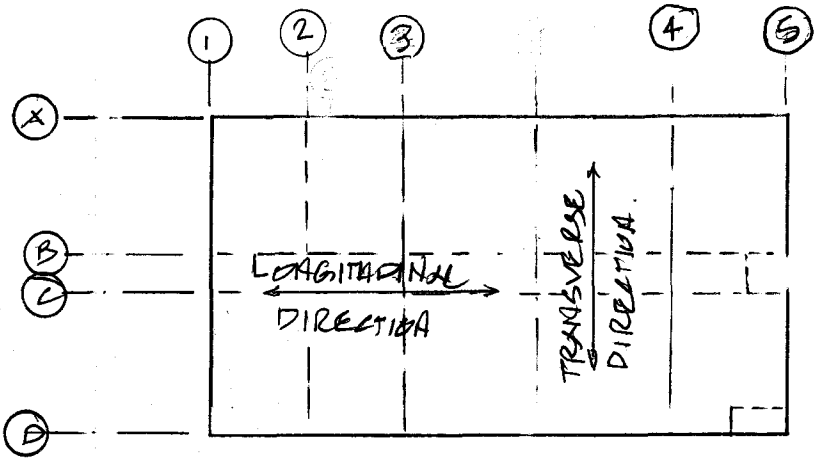
WHERE

C_S = THE SEISMIC RESPONSE COEFFICIENT = $\frac{S_{DS}}{R/I} = \frac{1.2}{6.5/1} = 0.184C$

S_{DS} = THE DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETER

IN THE SHORT PERIOD RANGE 0.2 SECONDS FOR SITE D = 1.2 FOR A LATTITUDE OF 37°42'48"N & A LONGITUDE OF 121°43'49.35"W ZIP CODE = 94551.

R = RESPONSE MODIFICATION FACTOR = 6.5, I = 1.0 = TIME OCCUPANCY IMPORTANCE FACTOR



PLAN

CONT'D LATERAL ANALYSIS

WIND SHEAR AT ROOF

TRANSVERSE DIRECTION = $(120'\text{-}0'')\left(\frac{16.5^2}{2\times12.0}\right)(18.5\text{LPSF}) = 25265.0^{\#}$

LONGITUDINAL DIRECTION = $(65'\text{-}0'')\left(\frac{16.5^2}{2\times12.0}\right)(18.5\text{LPSF}) = 13685.0^{\#}$

SEISMIC SHEAR = $V = 0.184W$; W = DEAD LOADS.

DEAD LOADS

CONSERVATIVE

ROOF = $\{(120'\text{-}0'')(65'\text{-}0'') + (12'\text{-}0'')(10'\text{-}0'')\}(20^{\#}\text{SF}) = 158400.0^{\#}$

EXTERIOR WALLS = $2(120'+65')\left(\frac{16.5^2}{2\times12}\right)(27\text{PSF}) = 113324.0^{\#}$

INTERIOR WALLS = $(67'\text{-}0'')(12/2)(9\text{PSF}) = 36504.0^{\#}$

TOTAL DEAD LOADS = $308228.0^{\#}$

$V = (0.184)(308228^{\#}) = 56900^{\#}$ - GOVERNS IN BOTH DIRECTIONS

SHEAR WALLS "L" = LENGTH OF SHEAR WALLS

TRANSVERSE WALLS

SHEAR TO END WALLS ON COL. LINE (1) = $\frac{56900}{120}\times\frac{20}{2} = 4742^{\#}$

$L = 2\times8' + 11'\text{-}6'' = 27'\text{-}6''$ MINIMUM; $\text{SHEAR}/' = 172.4^{\#}$ CONSERVATIVELY USE

$T=C = 172.40\times12 = 2069^{\#}$ USE HDU5-SDS2.5

1/2" PLYWD - 10d AT 4" o.c
5/8" DIA. A.B AT 32" o.c

SHEAR TO INTERIOR WALLS ON COL. LINE (2) = $\frac{56900}{120}\times\frac{40.33}{2} = 9562^{\#}$

$L = 2\times12'\text{-}0'' + 25'\text{-}0'' = 49'\text{-}0''$ MIN. $\text{SHEAR}/' = 195.13^{\#}$

$T=C = 195.13\times12 = 2342^{\#}$ HDU5-SDS2.5

1/2" PLYWD - 10d at 6" o.c
5/8" DIA A.B AT 48" o.c

SHEAR TO EXTERIOR WALLS ON COL. LINE (3) = $\frac{56900}{120}\times\frac{99.75}{2} = 23441^{\#}$

$L = 27'\text{-}6''\times2 = 55'\text{-}0''$ $\text{SHEAR}/' = 426.2^{\#}$

$T=C = 426.2\times12 = 5114^{\#}$ HDU8 SDS2.5

1/2" PLYWD - 16d at 3" o.c
5/8" DIA. A.B AT 24" o.c

CONTD LATERAL ANALYSIS : SHEAR WALLS.

TRANSVERSE WALLS - CONT'D

SHEAR TO REAR WALLS ON COL. LINE (5) = $\frac{56900}{120} \times \frac{79.83}{2}$ = 18926#

L = 2 x 28'-6" = 57'-0" ; SHEAR/' = 332# USE HDU5-SDS25. 1/2" plywd - 16d AT 4" oc
5/8" DIA. A.B AT 32" O.C

CONSERVATIVELY USE SHEAR WALL COL. LINE (4).

SHEAR = 18926#, L = 27'6"; SHEAR/' = 688# 1/2 PLYWD - 10d at 2" oc
T = C = 688 x 12 = 8254# HDQ 8-SDS3 16x6 5/8" DIA. A.B AT 12" oc
LONGITUDINAL WALLS SHEAR = 56900#

SHEAR TAKEN BY REAR WALLS ON COL. LINES (A) & (D)

SHEAR TO EACH SIDE = $\frac{56900}{65} \times \frac{28.5}{2}$ = 12474#

MINIMUM L = 11'-0" + 2 x 19'-0" + 16'-0" = 65'-0" SHEAR/' = 192# 1/2" plywd - 16d at 4" oc
5/8" DIA. A.B AT 32" oc

T = C = 192 x 12' = 2304# HDU5-SDS2.5

CONSERVATIVELY
SHEAR TAKEN BY INTERIOR WALLS ON COL. LINES (B) & (E)

= $\frac{56900}{65}\left(\frac{28'-6" + 8'-0"}{2}\right)$ = 1597#

MINIMUM L = 3 x 13.6" 40-6" ; SHEAR/' = 394.4# 1/2" plywd - 16d at 3" oc
5/8" DIA. A.B AT 24" oc

T = C = 394.46 x 12 = 4734# USE HDU5-SDS2.5

CHORD FORCES

DIAPHRAM RATIO = $\frac{53.34}{28'-6"}$ = 1.87 < 3.5

MAXIMUM DIAPHRAGM SHEAR = $\frac{56900 \times 53.34 \times 28.5}{120 \times 65}$ = 11090#

DIAPHRAGM SHEAR

TRANSVERSE DIRECTION = $\frac{11090}{2 \times 28.5}$ = 194.6# 10d at 4" oc

LONGITUDINAL DIRECTION = $\frac{11090}{2 \times 53.34}$ = 103.95' 16d at 6" oc

MAXIMUM CHORD FORCE = $\frac{11090 \times 53.34'}{8 \times 28.5}$ = 25.94# USE ST 6236

OR $\frac{11090 \times}{53.34'} \frac{28.5'}{2}$ = 740.9# - 8-16d NAILS

USE ST 6236 AT TOP CHORD SPLICE

FOUNDATION DESIGN

MAXIMUM LOAD PER FOOT OF BEARING WALLS

EXTERIOR WALLS AT COL. LINES Ⓐ & Ⓒ

ROOF LOAD = $\frac{28.5}{2}(20'+20') = 570.0^{\#}$

EXTERIOR WALL = (16.5)(27 PSF) = $446.0^{\#}$

TOTAL LOAD/' = $1016.0^{\#}$

INTERIOR WALLS AT COL. LINES Ⓑ & Ⓒ

ROOF LOAD = $\frac{(28.5'+8')}{2}(20+20) = 730.0^{\#}$

INTERIOR WALL = 12+9 = $168.0^{\#}$

TOTAL LOAD = $838.0^{\#}$

PER SOILS REPORT : USE A STRUCTURAL MAT USING 6'0" CANTILEVER,

ASSUMING 9" SLAB MINIMUM, SLAB WEIGHT = $112.5^{\#}/'$ + $50^{\#}/'$ LIVE LOAD

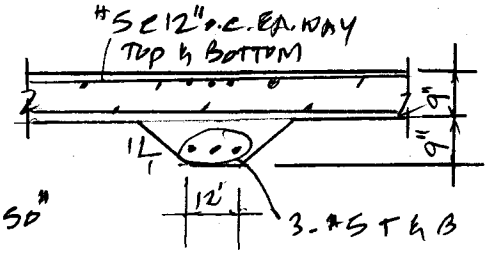
= $162.5^{\#}/'$

SLAB DESIGN $W = 162.5^{\#}/'$, $R = 162.5 \times 6 = 975^{\#}/'$

SHEAR STRESS = $\frac{975}{12 \times 5.5} = 14.77$ PSI $< 1.1\sqrt{2500} = 55$ PSI

$M = 162.5 \times 6^2/2 = 2925^{'\#}$; $A_s = \frac{2.925}{1.7 \times 5.5} = 0.312\,IN^2$ - #5 @ 12" O.C

USE 9" MAT SLAB WITH #5 @ 12" O.C EACH WAY AT TOP & BOTTOM



INTERIOR WALL FOOTINGS 12" × 18" MINIMUM,

$W = 838^{\#} + 162.5^{\#} = 1000.5^{\#}/'$ USE $1000^{\#}/'$

$R = 1000 \times L = 6000^{\#}$; $R_4 = 6000 - \frac{14.5}{12} \times 1000^{\#} = 4550^{\#}$

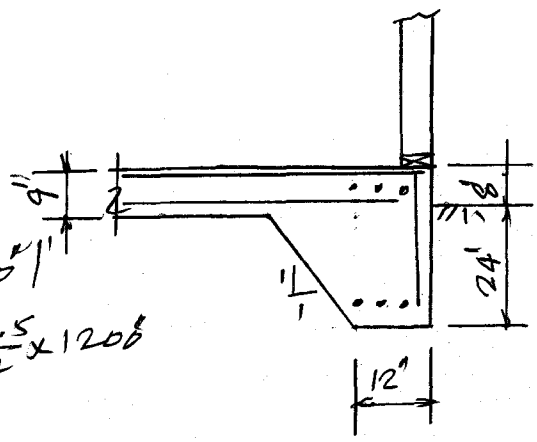
SHEAR STRESS = $\frac{4550}{12 \times 14.5} = 26.13$ PSI $< 1.1\sqrt{2500} = 55$ PSI

$M = 1 \times L^2/2 = 18^{'K}$; $A_s = \frac{18}{1.7 \times 14.5} = 0.705\,IN^2$ USE 3-#5 AT TOP & BOTTOM

COMBD FOUNDATION DESIGN

EXTERIOR WALL FOOTINGS

AS A 6'-0" CANTILEVER



$W = 1016^{\#}/' + 162.5^{\#} = 1178.5^{\#}$ USE $1200^{\#}/'$

$R = 1200 \times 6 = 7200^{\#}$; $R_d = 7200 - \frac{28.5}{12} \times 1200^{\#}$

$= 4350^{\#}$

SHEAR STRESS $= \frac{4350}{12 \times 28.5} = 12.72 PSI < 1.1\sqrt{2500} = 55 PSI$

$M = 1.2 \times 6^2/2 = 21.6^{1K}$; $AS = \frac{21.6}{17.6 \times 28.5} = 0.43 IN^2$ USE - 3-#5 AT TOP / 3-#5 AT BOTTOM

SEISMIC DEMANDS ON NON STRUCTURAL COMPONENTS.

AIR CONDITIONING UNITS AT ROOF TOP : MAXIMUM WEIGHT = 1750# USE 2000#

Fp = THE HORIZONTAL SEISMIC DESIGN FORCE

$$= \frac{0.4\, a_p\, S_{DS}\, W_p}{\left(\frac{R_p}{I_p}\right)} \left(1 + 2\,\frac{z}{h}\right)$$

WHERE

S_{DS} = SPECTRAL ACCELERATION, SHORT PERIOD = 1.2

a_p = COMPONENT APPLICATION FACTOR = 2.5

I_p = COMPONENT IMPORTANCE FACTOR = 1.0

W_p = COMPONENT OPERATING WEIGHT = 2000# MAXIMUM

R_p = COMPONENT RESPONSE MODIFICATION FACTOR = 6.0

z = HEIGHT IN STRUCTURE OF POINT OF ATTACHMENT OF COMPONENT WITH RESPECT TO THE BASE.

h = AVERAGE HEIGHT OF STRUCTURE WITH RESPECT TO BASE

z/h NEED NOT EXCEED 1.0

Fp = IS NOT REQUIRED TO BE TAKEN AS GREATER THAN $F_p = 1.6\, S_{DS} I_p W_p$ AND Fp SHALL NOT TAKEN LESS THAN $F_p = 0.3\, S_{DS} I_p W_p$.

$$F_p = \frac{(0.4)(2.5)(1.2)\, W_p}{6/1} \left(1 + 2\alpha 1\right) \quad (z/h = 1.0) = 0.6\, W_p$$

OR 1) $F_p = 1.6 \times 1.2 \times 1 \times W_p = 1.92\, W_p > 0.6\, W_p$

2) $F_p = 0.3 \times 1.2 \times 1 \times W_p = 0.36\, W_p < 0.6\, W_p$

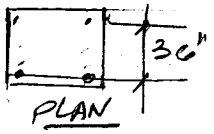
USE $F_p = 0.6\, W_p = 0.6 \times 2000\# = 1200\#$ SAY ACTING 2'-0" ABOVE ROOF.

ATTACHMENT OF UNIT TO ROOF MEMBERS

$M = 1200 \times 2 = 2400''\#$ $\quad T = C = \frac{2400 \times 12''}{36''} = 800\#$ — BOLT CENTERS

USE 5/8" DIA. BOLTS AT EACH CORNER

GOOD FOR $2 \times 530 = 1060\# > 800\#$ $\times 1.33$

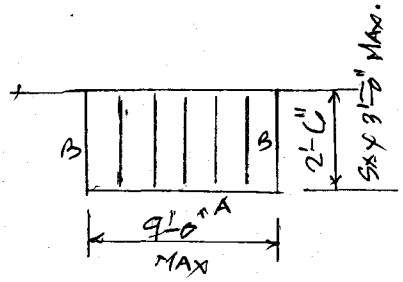


CANOPY OVER WINDOW OPENINGS

DEAD LOAD = 10 PSF (D.L)

LIVE LOAD = 20 PSF (L.L)

WIND = 2.6 × 15.5 PSF = 40.3 PSF.



DEAD + LIVE LOADS.

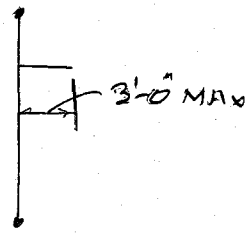
RAFTER A SPAN = 9'-0", $W = \frac{3}{2}(10+20) = 45^{\#}/'$

$R = 45 \times 9/2 = 202.5^{\#}$; $M = 45 \times 9^2/8 = 456'^{\#}$

$f_b = \frac{456 \times 12}{7.5625} = 723.57$ PSI 2×6

$H = \frac{202.5 \times 1.5}{8.25} = 36.82$ PSI

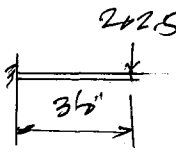
$\Delta = \frac{5 \times 45 \times 9^4 \times 1728}{384 \times 1.6 \times 10^6 \times 20.797} = 0.199"$; $L/\Delta = 541 > 240$



CANTILEVER JOISTS A $P = 202.5^{\#}$, $W = \frac{1.33}{2}(10+20) = 26.6^{\#}/'$

$R = 202.5 + 26.6 \times 3 = 282.3^{\#}$

$M = 202.5 \times 3 + 26.6 \times 3^2/2 = 727.2'^{\#}$ 2×8



$f_b = \frac{727.2 \times 12}{13.14} = 664.11$ PSI

$H = \frac{282.3 \times 1.5}{1.5 \times 7.25} = 38.94$ PSI

$\Delta = \frac{202.5 \times 3^3 \times 1728}{3 \times 1.6 \times 10^6 \times 47.635} + \frac{26.6 \times 3^4 \times 1728}{8 \times 1.6 \times 10^6 \times 47.635} = 0.0415" + 0.00614" = 0.0489"$

$L/\Delta = 736.7 > 1$

WIND UPLIFT

A ; $W = \frac{3}{2}(40.3 - \frac{2}{3} \times 10) = 50.4^{\#}/'$ (D.L) − 2×6 O.K BY INSPECTION

B $P = 50.4 \times 9/2 = 226.8^{\#}$, $W = \frac{1.33}{2}(40.3 - \frac{2}{3} \times 10) = 22.3^{\#}$

$M = 226.8 \times 3 + 22.3 \times 3^2/2 = 780.75'^{\#}$ 2×8 @ 16" O.C

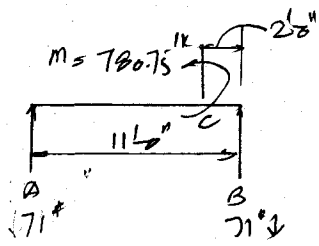
CONNECTION $T = C = \frac{780.75 \times 12}{4} = 2342^{\#}$ USE 2-5/8" DIA. BOLTS

CONT'D CANOPY

STUDS HEIGHT = 11'-6", OVERHANG MOMENT = 780.75'#

$R_A = R_B = \frac{780.75}{11} = 71^{\#}$

$M_{CA} = \frac{780.75 \times 9}{11} = 638.8^{'\#}$, $M_{CB} = 780.75 - 638.8 = 141.95^{'\#}$



USING 2×6, $f_b = \frac{638.8 \times 12}{7.5625 \times 1.6} = 633.5$ PSI

USE 2-2×6 AT EACH END TO TAKE CARE OF CANOPY & ROOF LOAD WITH WIND

INTERIOR PARTITION WALLS

DEAD LOAD = 8 PSF, SEISMIC LOAD = 0.184Cx8 PSF = 1.48 PSF < 5 PSF

USE 5 PSF PER CBC.

HEIGHT OF WALL = 11'-0", SHEAR/' OF WALL = 5x11 = 55#/'

5/8" DIAMETER ANCHOR BOLTS AT 5'0"

TRIBUTARY SHEAR/ BOLT = 5x55 = 275# < SMALL

PER CBC ALLOWABLE SHEAR IN CONCRETE = 2950# > 275#
TABLE 1911A.2

5/8" DIAMETER BOLT IS GOOD FOR 1.33x450 = 1263.5# > 275#
SEE ADS

3/8" DIAMETER HILTI KB-TZ - ANCHORS AT 32" o/c

TRIBUTARY SHEAR = $\frac{32}{12}$ x 55 = 146.7#

ALLOWABLE SHEAR = 3595# WITH 2" EMBEDMENT. TENSION CAPACITY = 1105#

THE PARTITION WALLS ARE MINIMUM 15'0" AND NO TRASION.

$T = C = \frac{55x11x15 - 0.85x88x15^2/2}{15}$ = 3# OF UPLIFT SMALL

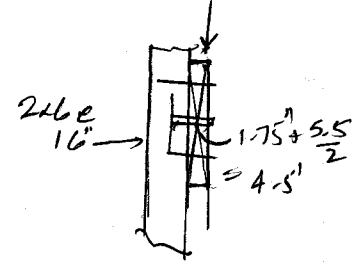
STUDS 2x6 @ 16" O.C. , MAXIMUM UNSUPPORTED HEIGHT = 11'-0"

TRY 2x6 STUDS AT 16" O.C

WIND LOAD = W = 1.33 (15.5 PSF) = 20.6 #/'

$M_1 = (20.6)(11^2/8) = 311.8'^{\#}$, $f_{b_1} = \frac{311.8 \times 12}{7.5625} = 494.76$ PSI

$P_{AXIAL} = 1.33 \times \frac{285}{2}(20 \times 20) = 758.1^{\#}$ $f_c = \frac{758.1}{8.25} = 91.89$ PSI



$e = 4.5'$

$M_2 = 758.1^{\#} \times 4.5'' = 3411.45'^{\#}$

$f_{b_2} = \frac{3411.45}{7.5625} = 451.1$ PSI

TOTAL $f_b = f_{b_1} + f_{b_2} = 494.76$ PSI $+ 451.1$ PSI $= 945.86$ PSI

$L/d_e = \frac{11 \times 12}{5.5} = 24 > 11 < K$

$K = 0.671\sqrt{\frac{E}{F_c(LOF)}} = 0.671\sqrt{\frac{1.6 \times 10^6}{625 \times 4.25}} = 30.37 > 24$

$F_c' = 1.25 \times 625\left[1 - 1/3\left(\frac{24}{30.37}\right)^4\right] = 680$ PSI.

$J = \frac{(L/d) - 11}{K - 11} = \frac{24 - 11}{30.37 - 11} = 0.671$

$F_b = 825 \times 1.33 = 1097.25$ PSI > 945.86 PSI

$\frac{f_c}{F_c'} + \frac{f_b}{F_b - J f_c} = \frac{91.89}{680} + \frac{854.76}{1097.25 - (0.671)(91.89\ PSI)}$

$= 0.14 + 0.82 = 0.96 < 1.0$

USE 2x6 @ 16" O.C

CONTD

EXPANSION OF 6x6 POST MAXIMUM HEIGHT = 9'-0" USE 10'-0" CONSERVATIVE

NO-1

$le/d = \frac{10x12}{5.5} = 21.82 > 11$

$K = 0.671\sqrt{\frac{E}{Fc(LDF)}} = 0.671\sqrt{\frac{1,600,000}{1200\,(1.0)}} = 24.5 > 21.5$

$Fc' = (1200)\left[1 - \frac{1}{3}\left(\frac{21.82}{24.5}\right)^4\right] = 948.4\ psi$

$P_{ALLOWABLE} = (948.4)(5.5)^2 = 28689^{\#} >$

SUPPORTS BEAMS FOR A.C. UNITS

SPAN = 28'-6", W = 2(20+20) = 80' USE 200#'

$P = \frac{2000}{2} = 1000^{\#}$ FROM A.C. UNITS

$R = \frac{200 \times 28.5}{2} + \frac{1000}{2}$ ← SAY AT ℄

$= 3350^{\#}$ USE $4000^{\#}$

$M = \frac{200 \times 28.5^2}{8} + \frac{1000 \times 28.5}{4} = 27431.25^{"\#}$ TRY $3\frac{1}{2} \times 16$ PSL

$f_b = \frac{27431.25 \times 12}{149.33} = 2204.3$ PSI

$H = \frac{4000 \times 1.5}{56} = 107.14$ PSI

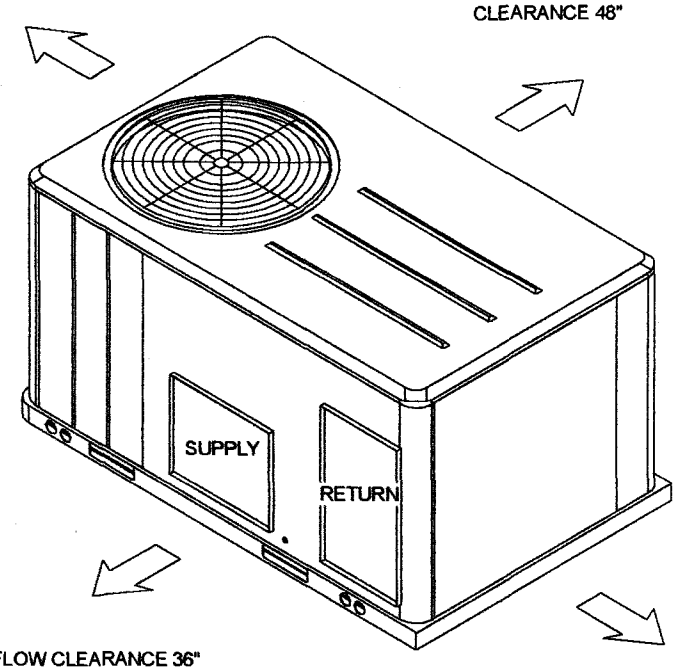
$\Delta = \frac{5 \times 200 \times 28.5^4 \times 1728}{384 \times 2 \times 10^6 \times 1194.67} + \frac{1000 \times 28.5^3 \times 1728}{48 \times 2 \times 10^6 \times 1194.67}$

$= 1.24" + 0.35 = 1.49" > \frac{28.5 \times 12}{240}$ USE $5\frac{1}{4} \times 16$ PSL

CLEARANCE FROM TOP OF UNIT 72"

CLEARANCE 36"

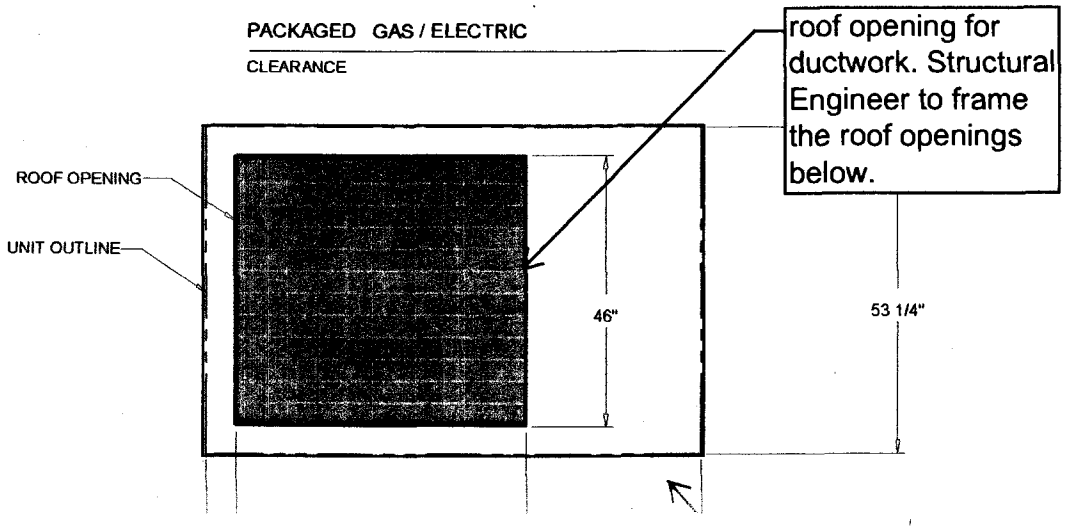
CLEARANCE 48"



DOWNFLOW CLEARANCE 36"

HORIZONTAL CLEARANCE 18"

CLEARANCE 36"



ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	YHC067E	Oversized Motor
Unit Operating Voltage:	187-253	MCA:
Unit Primary Voltage:	208	MFS:
Unit Secondary Voltage	230	MCB:
Unit Hertz:	60	
Unit Phase:	3	
SEER	17.5	
Standard Motor		Field Installed Oversized Motor
MCA:	32.2	MCA:
MFS:	45.0	MFS:
MCB:	45.0	MCB:

HEATING PERFORMANCE

HEATING - GENERAL DATA

Heating Model:	Low
Heating Input (Btu):	60,000
Heating Output (Btu):	49,000
No. Burners:	2
No. Stages	1
Gas Inlet Pressure	
Natural Gas (Min/Max):	4.5/14.0
LP (Min/Max)	11.0/14.0
Gas Pipe Connection Size:	1" / 2"

INDOOR MOTOR

Sandard Motor		Oversized Motor	Field Installed Oversized Motor
Number:	1	Number:	Number:
Horsepower:	1.0	Horsepower:	Horsepower:
Motor Speed (RPM):	--	Motor Speed (RPM):	Motor Speed (RPM):
Phase	1	Phase	Phase
Full Load Amps:	9.4	Full Load Amps:	Full Load Amps:
Locked Rotor Amps:	N/A	Locked Rotor Amps:	Locked Rotor Amps:

COMPRESSOR Circuit 1/2

Number:	1
Horsepower:	4.3
Phase:	3
Rated Load Amps:	16.2
Locked Rotor Amps:	110.0

OUTDOOR MOTOR

Number:	1
Horsepower:	0.40
Motor Speed (RRM):	1075
Phase:	1
Full Load Amps:	2.5
Locked Rotor Amps:	4.3

POWER EXHAUST ACCESSORY (3)

(Field Installed Power Exhaust)

Phase:	
Horsepower:	
Motor Speed (RPM):	
Full Load Amps:	
Locked Rotor Amps:	

FILTERS

Type:	Throwaway
Furnished:	Yes
Number	4
Recommended	16"x25"x2"

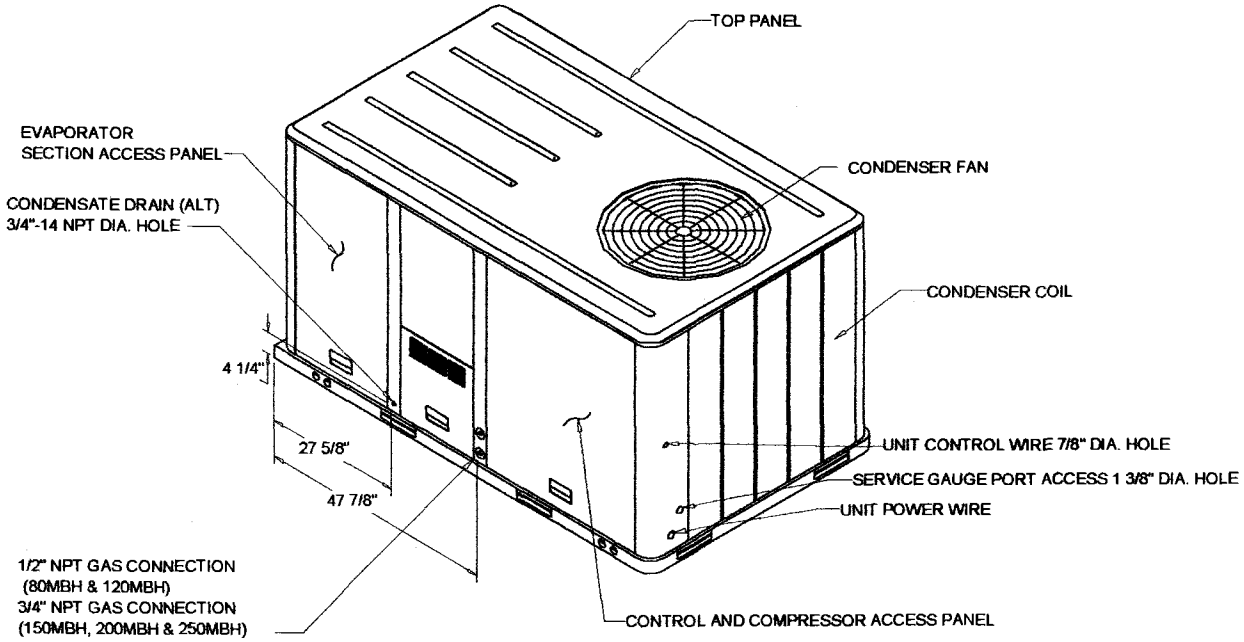
REFRIGERANT (2)

Type

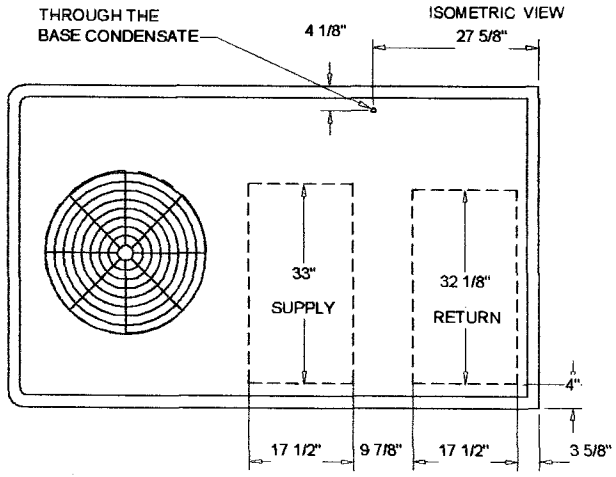
Factory Charge	
Ciruit #1	11.8
Ciruit #2	N/A

NOTES:

1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.



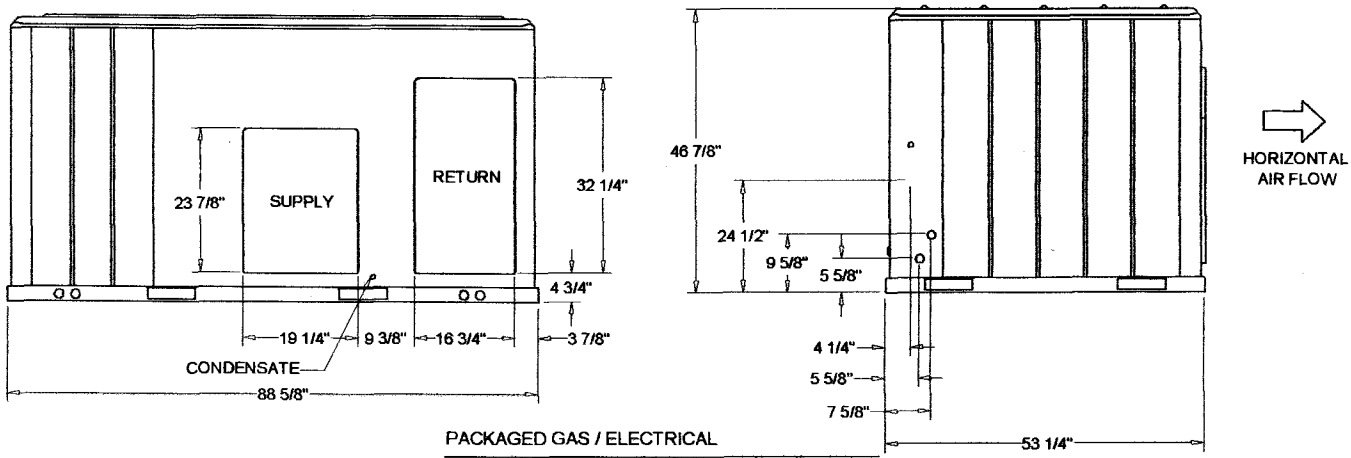
PACKAGED GAS / ELECTRICAL



NOTES:
1. THRU -THE -BASE ELECTRICAL IS NOT STANDARD ON ALL UNITS.
2. VERIFY ALL DIMENSIONS WITH INSTALLER DOCUMENTS BEFORE INSTALLATION.

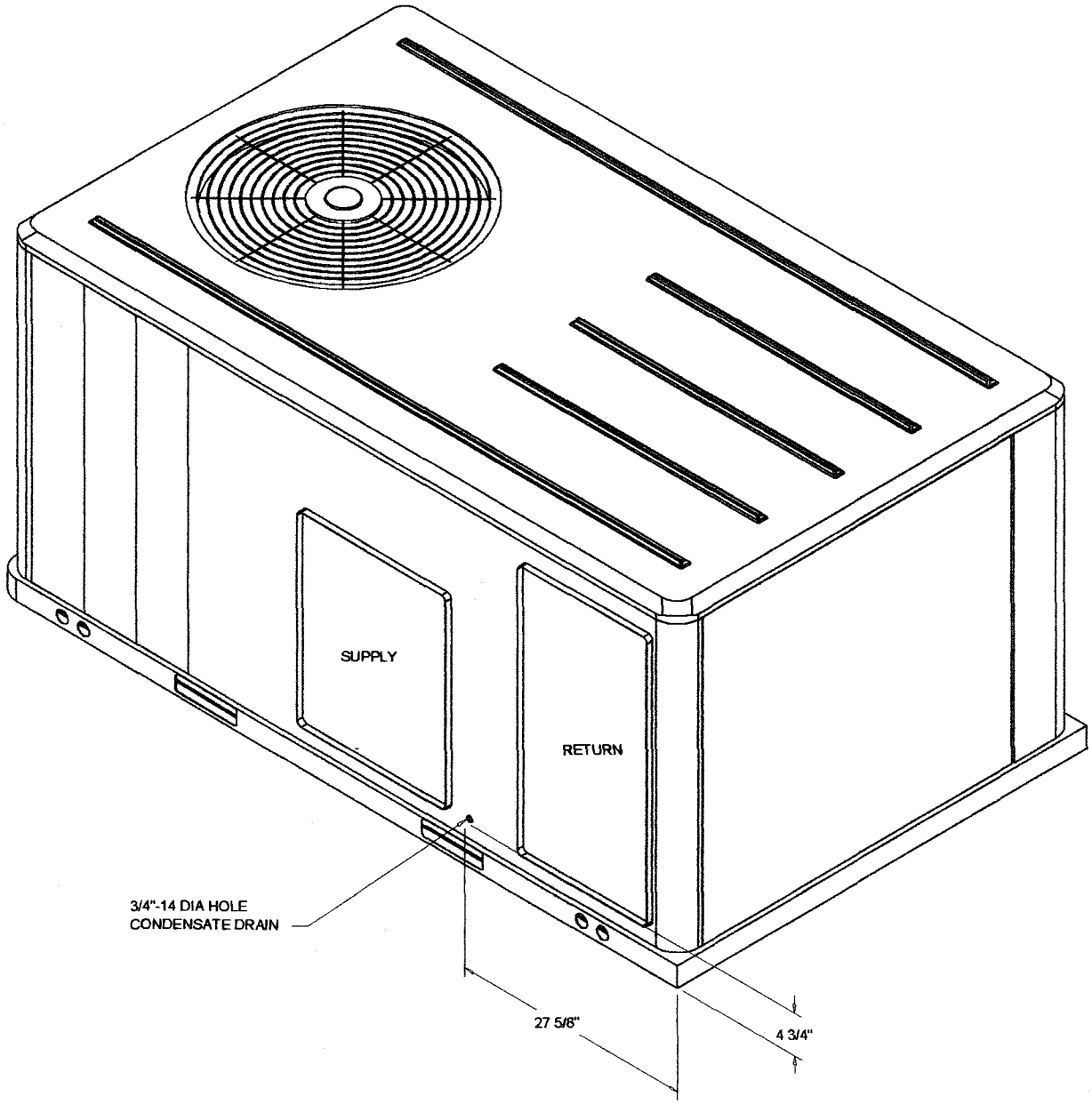
PLAN VIEW UNIT

DIMENSION DRAWING



PACKAGED GAS / ELECTRICAL

DIMENSION DRAWING



ISOMETRIC-PACKAGED COOLING

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	YHC072E	Oversized Motor	
Unit Operating Voltage:	187-253	MCA:	
Unit Primary Voltage:	208	MFS:	
Unit Secondary Voltage	230	MCB:	
Unit Hertz:	60		
Unit Phase:	3		
EER	12.6		
Standard Motor		Field Installed Oversized Motor	
MCA:	33.9	MCA:	
MFS:	50.0	MFS:	
MCB:	50.0	MCB:	

HEATING PERFORMANCE

HEATING - GENERAL DATA

Heating Model:	Low
Heating Input (Btu):	80,000
Heating Output (Btu):	64,800
No. Burners:	2
No. Stages	1
Gas Inlet Pressure	
Natural Gas (Min/Max):	4.5/14
LP (Min/Max)	10.0/14.0
Gas Pipe Connection Size:	1/2"

INDOOR MOTOR

Sandard Motor		Oversized Motor	Field Installed Oversized Motor
Number:	1	Number:	Number:
Horsepower:	1.0	Horsepower:	Horsepower:
Motor Speed (RPM):	--	Motor Speed (RPM):	Motor Speed (RPM):
Phase	3	Phase	Phase
Full Load Amps:	4.0 - 5.0	Full Load Amps:	Full Load Amps:
Locked Rotor Amps:	24.5	Locked Rotor Amps:	Locked Rotor Amps:

COMPRESSOR Circuit 1/2

Number:	1
Horsepower:	4.9
Phase:	3
Rated Load Amps:	20.5
Locked Rotor Amps:	155.0

OUTDOOR MOTOR

Number:	1
Horsepower:	0.7
Motor Speed (RRM):	1100
Phase:	1
Full Load Amps:	3.3
Locked Rotor Amps:	9.5

POWER EXHAUST ACCESSORY (3)

(Field Installed Power Exhaust)

Phase:	
Horsepower:	
Motor Speed (RPM):	
Full Load Amps:	
Locked Rotor Amps:	

FILTERS

Type:	Throwaway
Furnished:	Yes
Number	4
Recommended	20"x25"x2"

REFRIGERANT (2)

Type	R-410
Factory Charge	
Ciruit #1	14.3 lb
Ciruit #2	

NOTES:

1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	YHC092F	Oversized Motor
Unit Operating Voltage:	187-253	MCA:
Unit Primary Voltage:	208	MFS:
Unit Secondary Voltage	230	MCB:
Unit Hertz:	60	
Unit Phase:	3	
EER	12.6	
Standard Motor		Field Installed Oversized Motor
MCA:	41.9	MCA:
MFS:	50.0	MFS:
MCB:	50.0	MCB:

HEATING PERFORMANCE

HEATING - GENERAL DATA

Heating Model:	Low
Heating Input (Btu):	120,000
Heating Output (Btu):	96,000
No. Burners:	3
No. Stages	1
Gas Inlet Pressure	
Natural Gas (Min/Max):	4.5/14
LP (Min/Max)	10.0/14.0
Gas Pipe Connection Size:	1/2"

INDOOR MOTOR

Sandard Motor		Oversized Motor	Field Installed Oversized Motor
Number:	1	Number:	Number:
Horsepower:	3.8	Horsepower:	Horsepower:
Motor Speed (RPM):	--	Motor Speed (RPM):	Motor Speed (RPM):
Phase	3	Phase	Phase
Full Load Amps:	8.5 - 8.5	Full Load Amps:	Full Load Amps:
Locked Rotor Amps:	--	Locked Rotor Amps:	Locked Rotor Amps:

COMPRESSOR Circuit 1/2

Number:	2
Horsepower:	3.8 / 2.8
Phase:	3
Rated Load Amps:	15.9/10.0
Locked Rotor Amps:	110.0/71.0

OUTDOOR MOTOR

Number:	1
Horsepower:	0.75
Motor Speed (RRM):	1100
Phase:	1
Full Load Amps:	3.5
Locked Rotor Amps:	9.3

POWER EXHAUST ACCESSORY (3)

(Field Installed Power Exhaust)

Phase:	
Horsepower:	
Motor Speed (RPM):	
Full Load Amps:	
Locked Rotor Amps:	

FILTERS

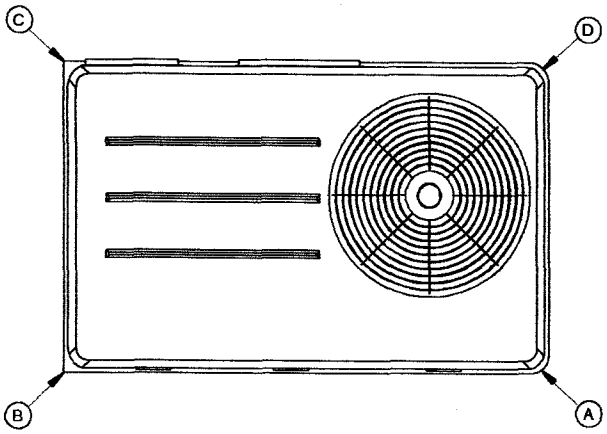
Type:	Throwaway
Furnished:	Yes
Number	4
Recommended	20"x25"x2"

REFRIGERANT (2)

Type	R-410
Factory Charge	
Ciruit #1	5.5 lb
Ciruit #2	4.2 lb

NOTES:

1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.



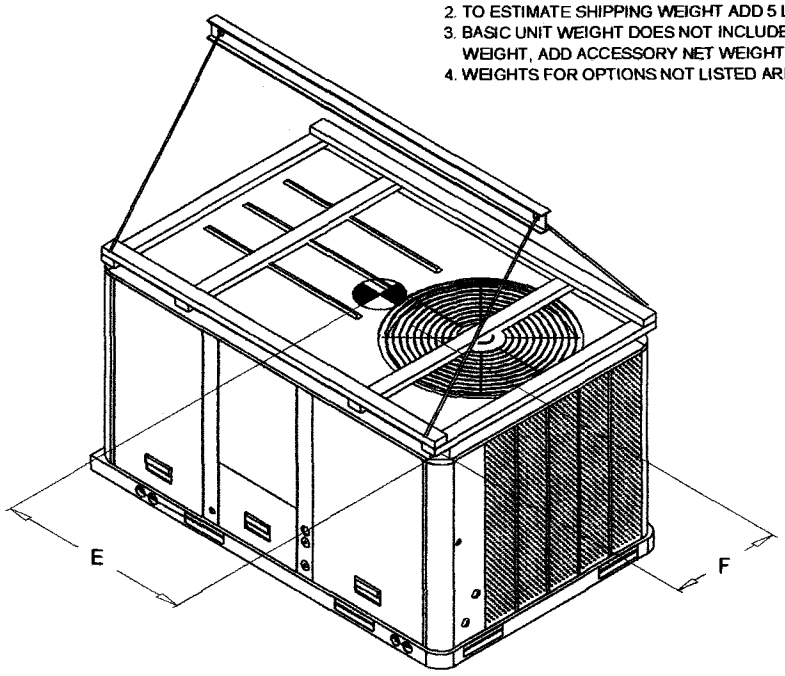
PACKAGED GAS / ELECTRICAL
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	36.0 lb
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	
HAIL GUARD	
SMOKE DETECTOR, SUPPLY / RETURN	5.0 lb
NOVAR CONTROL	
STAINLESS STEEL HEAT EXCHANGER	
REHEAT	
ROOF CURB	78.0 lb

BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	(A)	238.0 lb	(C)	148.0 lb	(E) LENGHT	(F) WIDTH
858.0 lb	763.0 lb	(B)	200.0 lb	(D)	176.0 lb	40"	23"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY.
2. TO ESTIMATE SHIPPING WEIGHT ADD 5 LBS TO NET WEIGHT.
3. BASIC UNIT WEIGHT DOES NOT INCLUDE ACCESSORY WEIGHT. TO OBTAIN TOTAL WEIGHT, ADD ACCESSORY NET WEIGHT TO BASIC UNIT WEIGHT.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE >5 LBS.

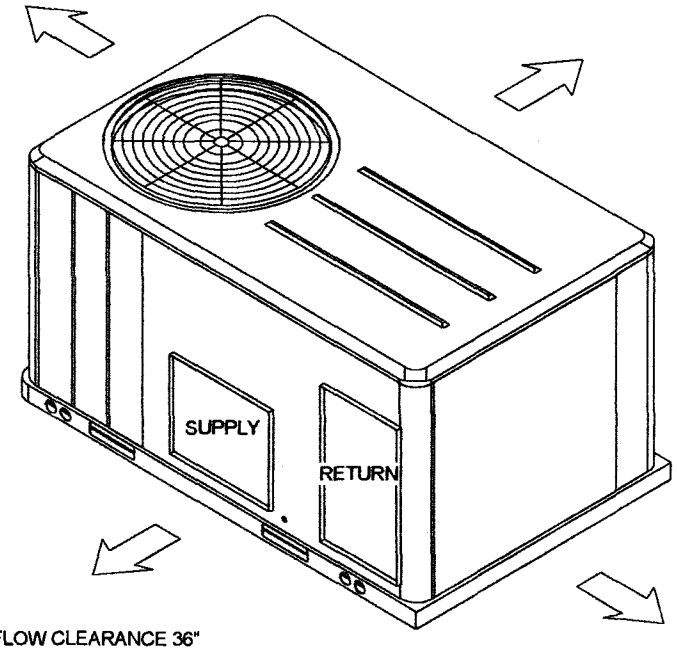


PACKAGED GAS / ELECTRICAL
RIGGING AND CENTER OF GRAVITY

CLEARANCE FROM TOP OF UNIT 72"

CLEARANCE 36"

CLEARANCE 48"



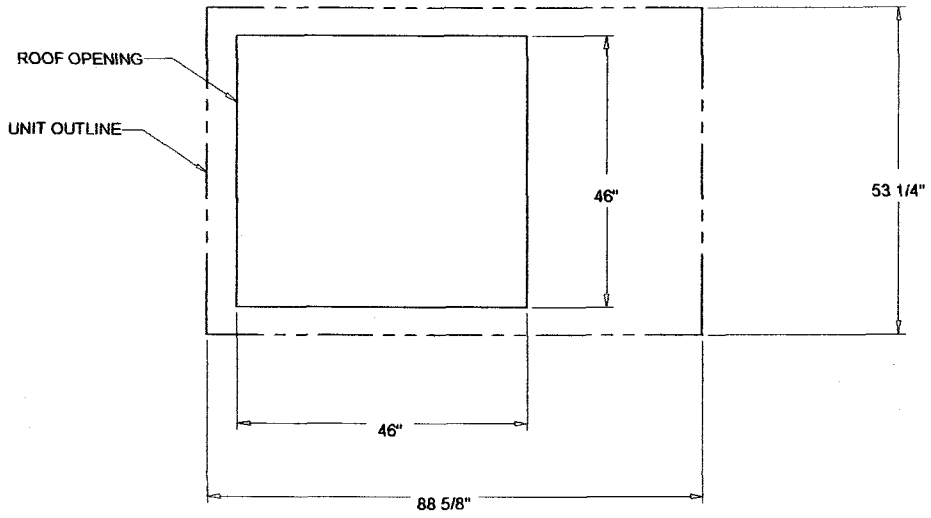
DOWNFLOW CLEARANCE 36"

HORIZONTAL CLEARANCE 18"

CLEARANCE 36"

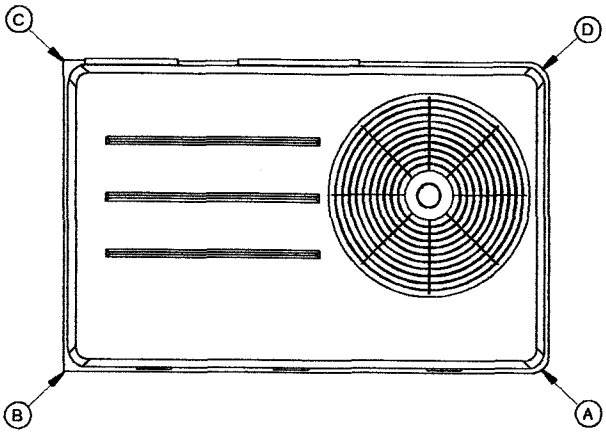
PACKAGED GAS / ELECTRIC

CLEARANCE



PACKAGED GAS / ELECTRIC

DOWNFLOW TYPICAL ROOF OPENING



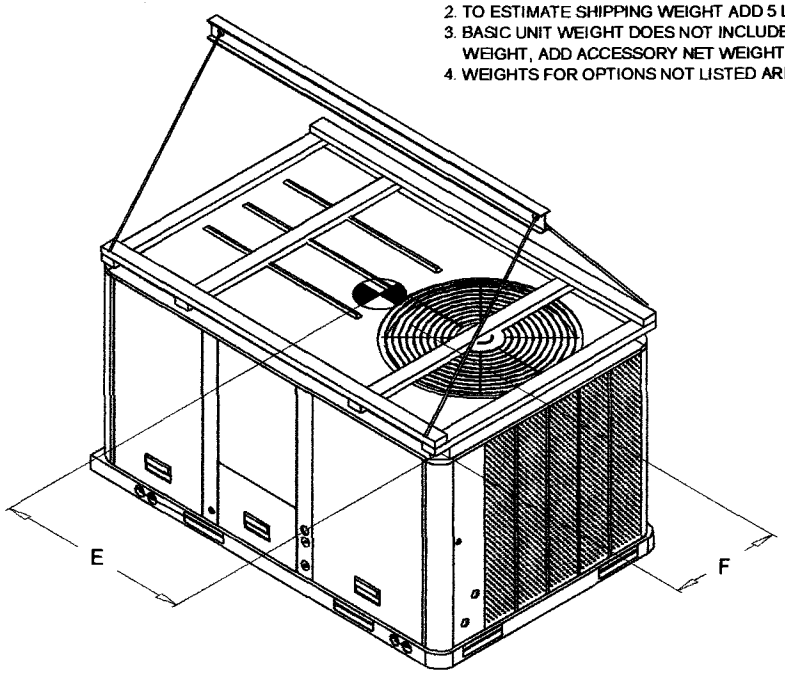
PACKAGED GAS / ELECTRICAL
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

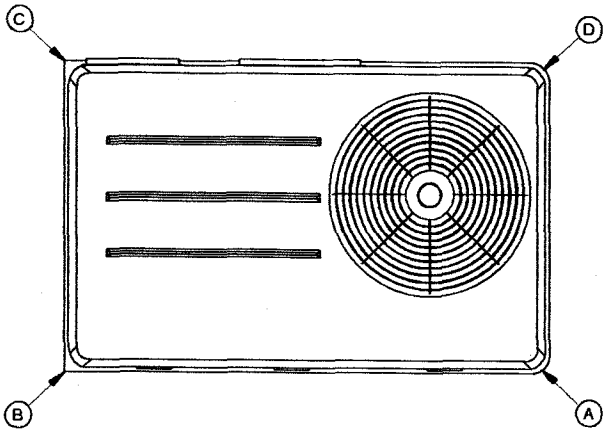
ACCESSORY	WEIGHTS
ECONOMIZER	36.0 lb
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	12.0 lb
HAIL GUARD	
SMOKE DETECTOR, SUPPLY / RETURN	5.0 lb
NOVAR CONTROL	
STAINLESS STEEL HEAT EXCHANGER	
REHEAT	
ROOF CURB	78.0 lb

BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	(A)	274.0 lb	(C)	180.0 lb	(E) LENGHT	(F) WIDTH
997.0 lb	900.0 lb	(B)	250.0 lb	(D)	196.0 lb	42"	22"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY.
2. TO ESTIMATE SHIPPING WEIGHT ADD 5 LBS TO NET WEIGHT.
3. BASIC UNIT WEIGHT DOES NOT INCLUDE ACCESSORY WEIGHT. TO OBTAIN TOTAL WEIGHT, ADD ACCESSORY NET WEIGHT TO BASIC UNIT WEIGHT.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE >5 LBS.



PACKAGED GAS / ELECTRICAL
RIGGING AND CENTER OF GRAVITY



PACKAGED GAS / ELECTRICAL

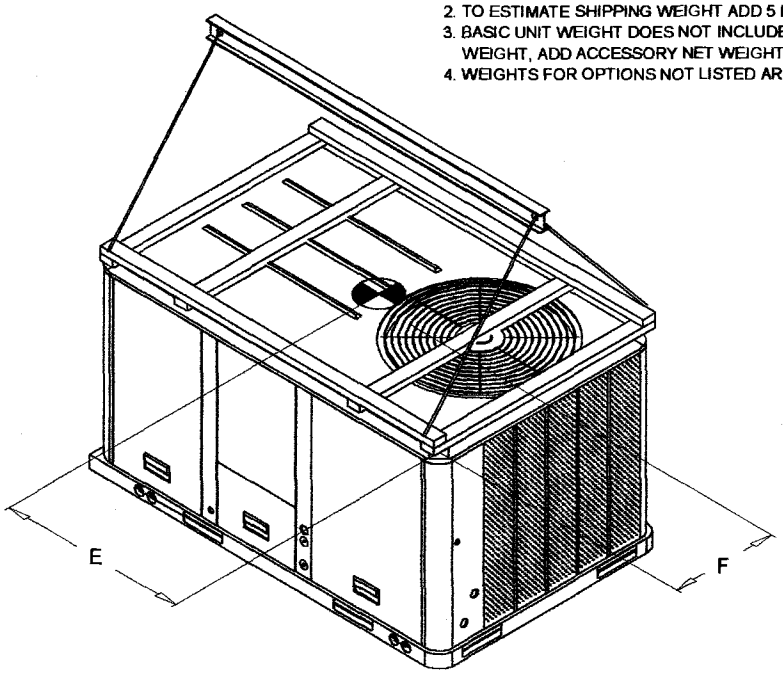
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	36.0 lb
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	80.0 lb
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	
HAIL GUARD	
SMOKE DETECTOR, SUPPLY / RETURN	5.0 lb
NOVAR CONTROL	
STAINLESS STEEL HEAT EXCHANGER	
REHEAT	
ROOF CURB	78.0 lb

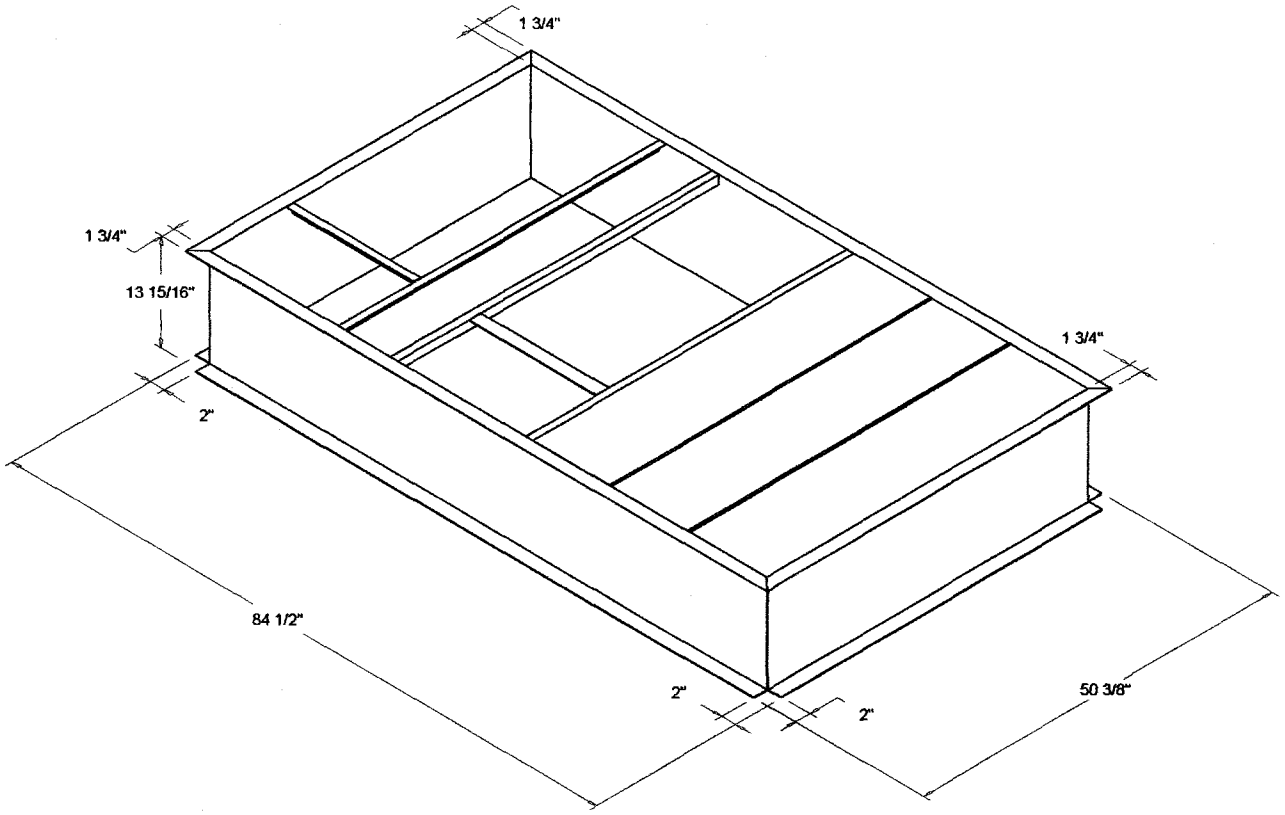
BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	(A)	340.0 lb	(C)	249.0 lb	(E) LENGHT	(F) WIDTH
1124.0 lb	1026.0 lb	(B)	233.0 lb	(D)	204.0 lb	41"	23"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY.
2. TO ESTIMATE SHIPPING WEIGHT ADD 5 LBS TO NET WEIGHT.
3. BASIC UNIT WEIGHT DOES NOT INCLUDE ACCESSORY WEIGHT. TO OBTAIN TOTAL WEIGHT, ADD ACCESSORY NET WEIGHT TO BASIC UNIT WEIGHT.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE >5 LBS.

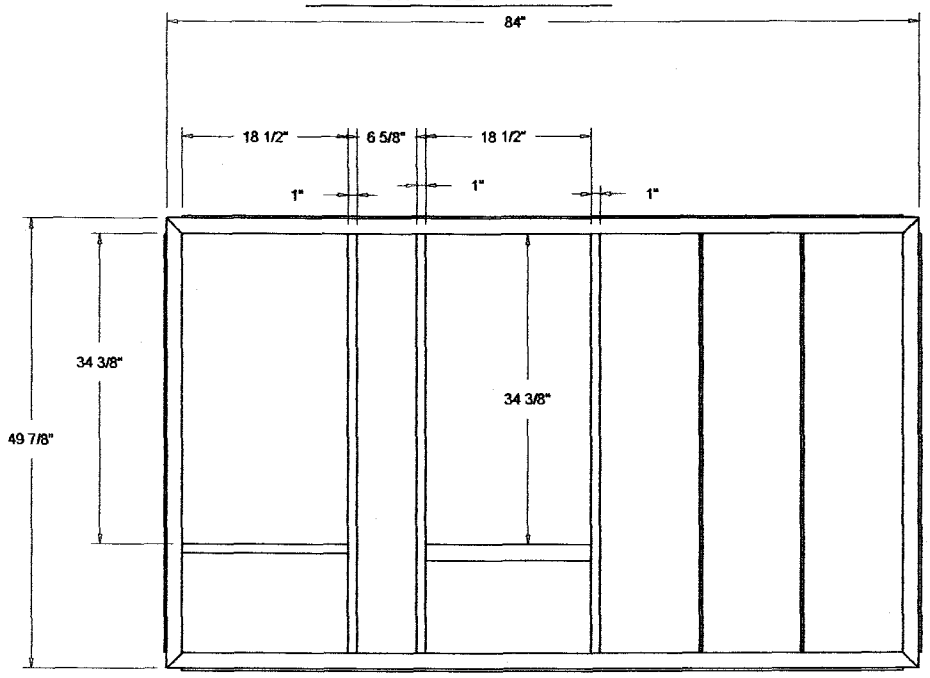


PACKAGED GAS / ELECTRICAL

RIGGING AND CENTER OF GRAVITY



ACCESSORY - ROOF TOP CURB



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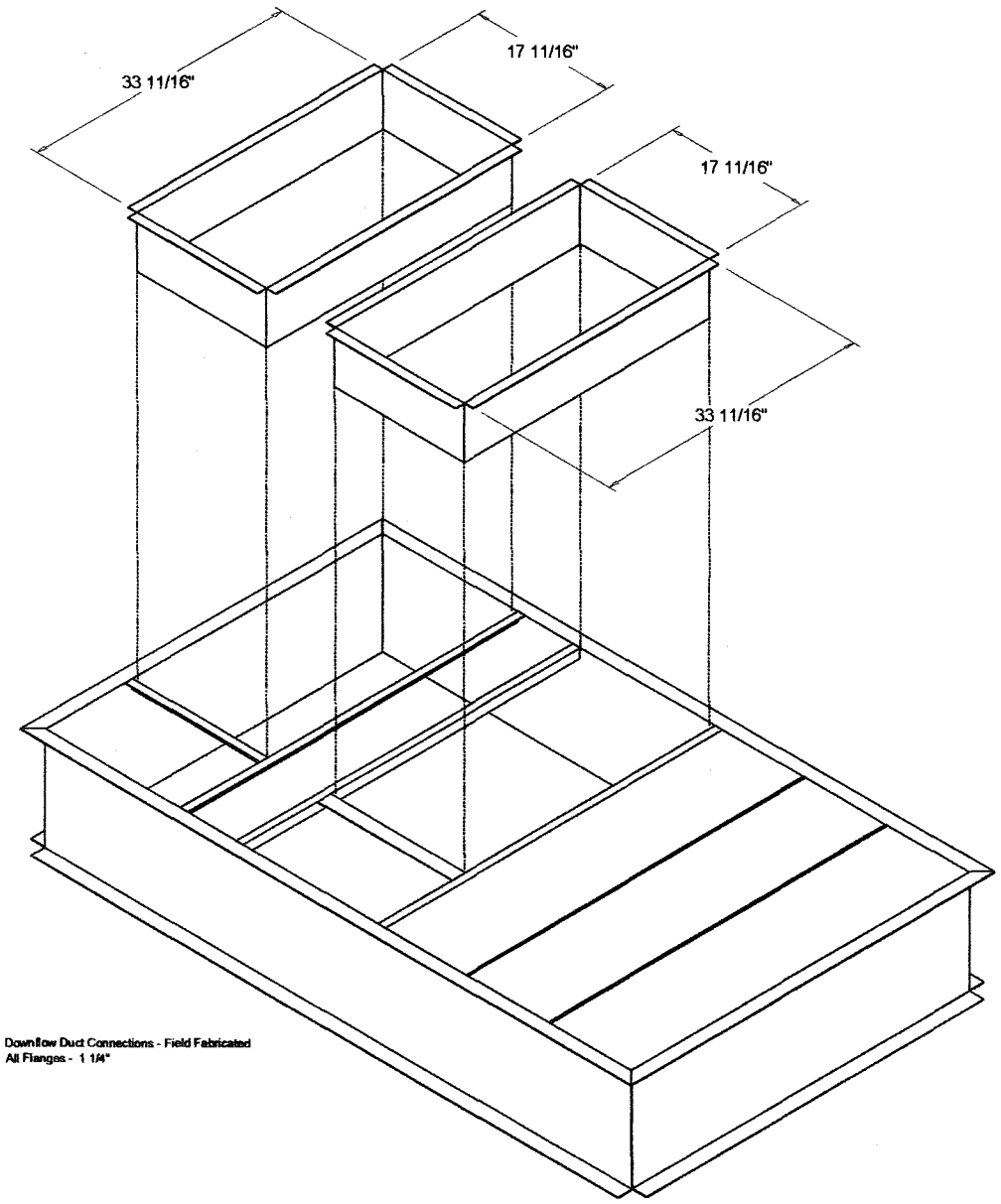
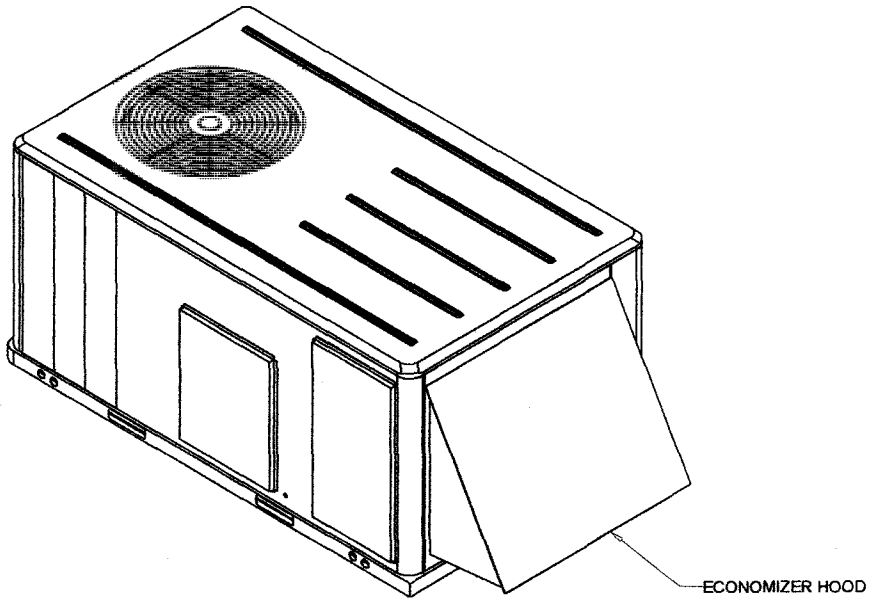
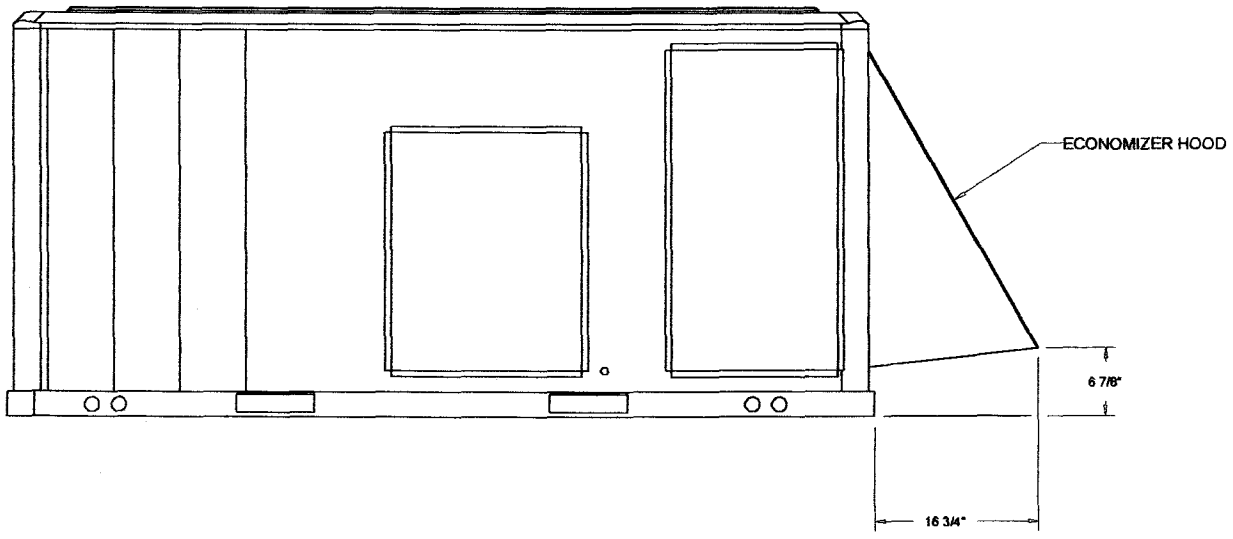
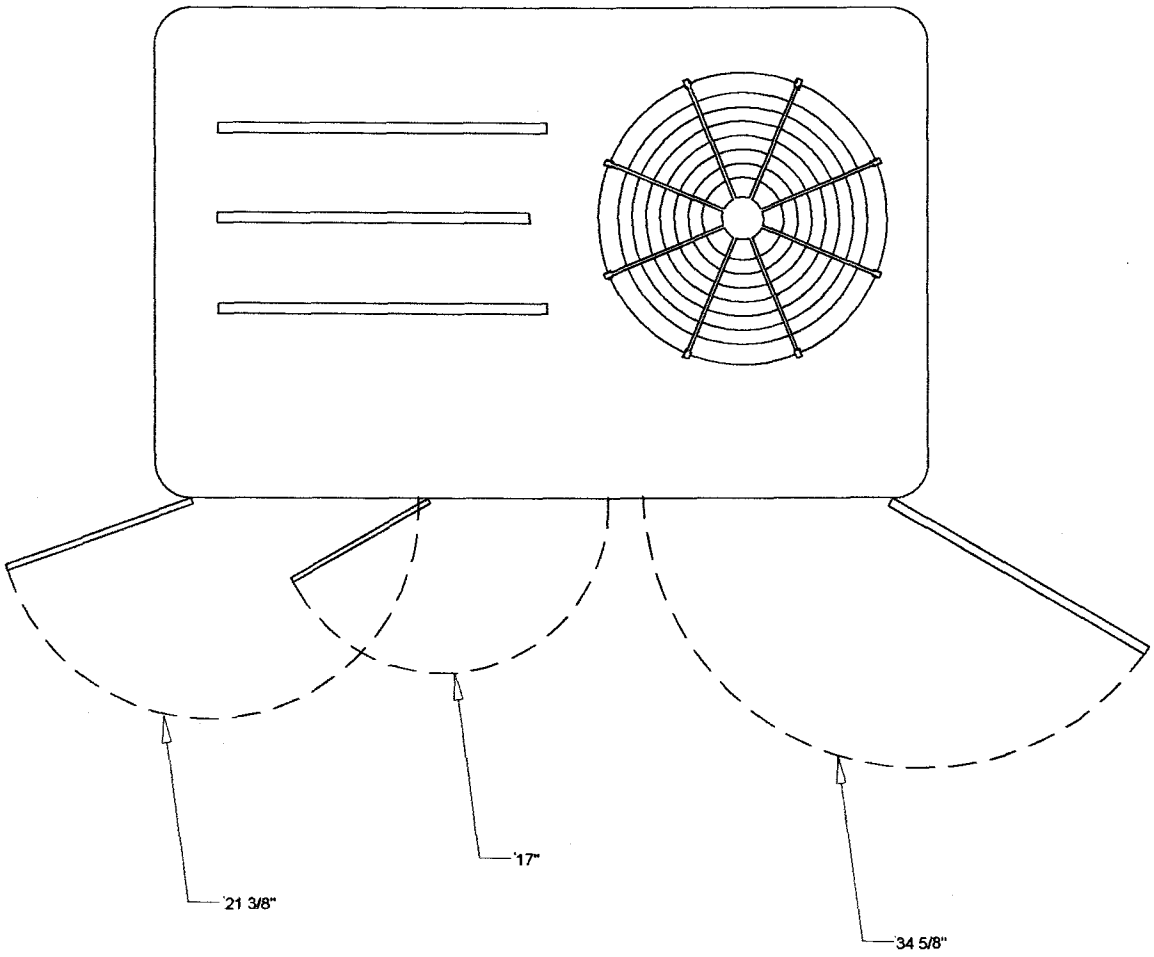


ACCESSORY - DUCT CONNECTIONS





ACCESSORY - ECONOMIZER HOOD



SWING DIAMETER - HINGED DOOR(S) OPTION

ACCESSORY

HINDU COMMUNITY

AND

CULTURAL CENTER

Building D

Soils

Report

GEOTECHNICAL INVESTIGATION
Proposed Two New Buildings and
Structural Addition to Existing Building
1232 Arrowhead Avenue
Livermore, California

Prepared for:
Hindu Community Cultural Center
1232 Arrowhead Avenue
Livermore, CA 94551

Prepared by:
HENRY JUSTINIANO & ASSOCIATES
August, 2009

HENRY JUSTINIANO & ASSOCIATES
GEOTECHNICAL ENGINEERING

HENRY JUSTINIANO & ASSOCIATES
GEOTECHNICAL ENGINEERING

Project No. H-140-01
August 10, 2009

Hindu Community Cultural Center
1232 Arrowhead Avenue
Livermore, CA 94551

SUBJECT: GEOTECHNICAL INVESTIGATION
Proposed Two New Buildings and
Structural Addition to Existing Building
1232 Arrowhead Avenue
Livermore, California

Gentlemen:

Our geotechnical report for the site of the proposed two new buildings and structural addition to the existing Assembly Hall, is herewith submitted. The report presents the results of our explorations and review of published geologic maps and reports, along with our evaluations and recommendations for foundation design, and other earthwork related elements of the project.

In our opinion, the site is suitable for the proposed improvements provided the recommendations presented in this report, are incorporated into the design and adhered to during construction.

If you should have any questions or need further assistance, please do not hesitate to contact this office.

Respectfully Submitted,

HENRY JUSTINIANO & ASSOCIATES

Henry Justiniano, P.E.
Calif. No. C-42347
Exp. 3/31/2010

Enclosures
cc: Addressee (5)
G. Rao (1)

P.O. Box 2338 * San Ramon, CA 94583
(925) 831-9092 * FAX (925) 831-3716

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE

This report presents the results of our investigation of the subject property, and the review of the published geological data pertaining to the general area.

General engineering design and geotechnical recommendations are provided, based upon the physical and strength characteristics of the subsurface materials, and take into consideration the proposed project's requisites.

1.2 SITE LOCATION

The subject site is located in the Spring Town District of the City of Livermore. Specifically, the site lies on the western side of the Arrowhead Avenue, between Treeflower and Goldenrod Drives. The precise location is illustrated on the Site Location Map, Figure 1.

1.3 SITE CHARACTERIZATION

The subject property can be characterized as two, rectangularly shaped parcels that encompass roughly 8.0 acres (Figure 2). The setting conforms to the densely populated residential area along the northeastern fringes of the relatively flat lowlands of the Livermore Valley. At present, the northern parcel hosts a Temple; an Assembly Hall; and ancillary parking that were constructed in the mid-1980's. The southern parcel is essentially vacant with a gravel surface that presently serves as a parking lot extension.

1.4 SCOPE

The scope of our work included a literature research of available and applicable geological and geotechnical data, and exploratory borings and logging of the foundation soils encountered during the field investigation. The soil data compiled was analyzed in support of the recommendations presented herein.

1.5 PROPOSED IMPROVEMENTS

In accordance with the information furnished to this office, it is proposed to expand the existing Assembly Hall and construct two new buildings on the southern parcel. In addition, the proposed improvements will include two new parking lots (Figure 2).

1.6 SUMMARY OF RESULTS

Based upon the results of our evaluations, we conclude that there are no geotechnical nor geologic considerations that would preclude the proposed site improvements. Information from our review of geological maps, the existing topography, and our exploration program, indicates that the proposed building locations are within acceptably stable terrain, and that the site would be feasible for the proposed structural addition and buildings, provided that the recommendations presented herein are incorporated into the design and adhered to, during the construction phases of the project.

2.0 GEOLOGY

2.1 REGIONAL GEOLOGY

The project site is situated within the central portion of the Coast Range Province of Northwestern California. The Coast Range Province is characterized by a structural domain that is locally controlled by north to northwest trending, subparallel mountain ridges, and narrow valleys. The internal structures are often complex folds that are associated with structural deformations that have been created by a compressional regime during the Middle Mesozoic through Early Cenozoic Eras.

Tectonic features of the region reflect a deep crustal, northwestward movement of the Pacific Plate, relative to the North American Plate. Surface displacement is largely recognized along the San Andreas Fault Zone. However, the plate boundary movement is distributed among several faults between the Pacific Ocean and Western Nevada. These major faults are often characterized by a series of parallel anastomosing fault splays that develop at the surface, in response to the differential subsurface movement.

Historically, the active faults in the San Francisco Bay Region are, from west to east, the San Gregorio, the San Andreas, the Hayward, and the Calaveras Faults. These faults remain locked and quiet over periods of tens to hundreds of years. During quiet periods, strain builds up by gradual deformation of the crust adjacent to the fault. This strain is relieved periodically in sudden fault displacements that produce earthquakes. The displacement for Bay Area faults is dominantly right-lateral strike slip, with minor oblique slip component movements.

2.2 SITE GEOLOGY

Recent compilation in the geologic map published by Graymer et al. (1997, Figure 3) indicates that the site is underlain by Pleistocene age, alluvial deposits. The deposits are described as brown, dense gravelly and clayey sand or clayey gravel that fines grades upward to sandy clay.

In general, the near surface sediments at the subject site were identified as sandy clays and clayey sands, which are in general agreement with the above cited descriptions.

2.3 FAULTING/SEISMICITY

The property is not within a current Alquist Priolo Earthquake Hazard Zone (formerly a Special Studies Zone), and previous mapping does not depict active fault traces through the site. During our

reconnaissance we did not observe any geomorphic conditions within the property that would suggest the presence of an active fault trace.

Table I below presents an assessment of the faults that contribute the most significant ground-motion hazard to the site. Included in the Table is the shortest distance between the site and each fault (as measured in kilometers from the surface trace projection of the fault); the maximum moment magnitude (Mw) for the Upper Bound Earthquake (UBE) estimated for each fault.

TABLE 1
FAULT DISTANCE - MAGNITUDE - ACCELERATION

Active Fault System	Distance		Upper Bounds Magnitude (Mw)
	Miles	Kilometers	
Hayward	17.0	27.4	7.1
Calaveras	10.8	17.4	6.8
Concord-Green Valley	17.1	27.5	6.9
Greenville-Marsh Creek	1.8	2.9	6.9
San Andreas (Northern)	35.1	56.5	7.9

(Mw): Estimated Moment Magnitude from CDMG (1996) Open File Report 96-08.

The Design Basis Earthquake (DBE) ground motion is defined to have a 10% chance of exceedance in 50 years (475 year return period). Development of the DBE ground motion value requires a site specific Probabilistic Seismic Hazard Analysis (PSHA). A peak ground acceleration (PGA) estimate of 0.505 for the Design Basis Earthquake (10% probability of exceedance in 50 years) is presented in the California Geological Survey's web site for a Probabilistic Seismic Hazards Assessment for an alluvium site (Figure 4). The subject area is assigned a high hazard rating, due to its proximity to several faults . . . in particular, the Greenville or Calaveras Faults.

In summary, it will be necessary to design and construct the project in strict adherence with current standards for earthquake-resistant construction. Because of the proximity of the Greenville Fault, we would recommend that the structural design consider the potential for strong to very strong ground shaking, and that the design conform to the requirements of the California Building Code (2007).

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

3.1 FIELD INVESTIGATION

A site investigation was conducted by our firm on August 6, 2009, at the site of the proposed improvements. The subsurface exploration consisted of drilling three augered boring, with a truck mounted rotary drill rig. The boring were advanced with 4-inch O.D. augers, to a maximum depth of 50-feet. Based on our careful monitoring during the drilling, the absence of borehole collapse could be assured. As such, it was determined that the hollow stem augers that were on standby, were not necessary. The approximate locations of the borings are presented on the Site Plan, Figure 2.

The samples collected during our investigation, consisted of relatively undisturbed samples obtained by advancing into undisturbed soil, a Standard Penetration split barrel sampler, through the action of a 140-pound hammer falling a distance of 30-inches. A conventional rope and cat head arrangement was used to lift the hammer so that while energy measurements were not made, the energy ratio might be expected to be in the order of 60 percent. The in-situ strength characteristics of the underlying soil are indicated by correlating the blow counts required to drive the sampler the lower 12-inches of a 18-inch sample attempt. The soils encountered were examined and logged in the field by an Engineer from this office. The soil profiles are presented as Figures 7 thru 10.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected samples, in order to identify some of their engineering properties. Testing was conducted to establish grain size distributions and Atterberg limits for soil classification. In addition, in-situ moisture contents were measured.

The determination of Atterberg limits is used to correlate consistency changes with moisture variation, which is indicative of the expansion potential of the soil (ASTM D-4943) and to evaluate the liquefaction susceptibility of the underlying soils. Atterberg limits testing was performed on nine samples from variable depths. The results yielded Liquid Limits between 29 and 51, along with a Plasticity Index ranging from 13 to 37, which corresponds to clays of moderate to high plasticity.

Sieve analyses conducted to obtain grain size distributions of the encountered materials. In general the underlying stratigraphy was classified as sandy clay.

4.0 SUBSURFACE CONDITIONS

4.1 GENERAL

The results of our geological research, and confirmed by our exploration, indicate that the subject site is underlain by sandy clays and clayey sands. As mapped, these materials correspond to Pleistocene Period, alluvial fan and fluvial deposits. An approximate 4-foot thick, highly expansive silty clay topsoil blankets the site. Beneath the surface mantle, predominantly stiff, clayey soils with intermittent loose to medium dense, clayey sand layers, were revealed to the explored depth of 50-feet.

Groundwater was encountered at depths between 9 and 11-feet.

4.2 POTENTIAL FOR LIQUEFACTION AND SEISMICALLY-INDUCED SETTLEMENT

Liquefaction occurs when a loose, saturated granular deposit changes from a solid to a liquid state, due to particle densification and increased pore pressures during seismic shaking. Recent mapping by William Lettis & Associates, California Division of Mines and Geology and the USGS (2006, Figure 5), assigns the site to alluvial fan deposits that are described as having a moderate liquefaction susceptibility. Official Mapping by the State of California, delineating Seismic Hazard Zones (2009, Figure 6), assigns the subject site to the eastern fringes of an area with a potential for liquefaction. While the maps shown in Figures 5 and 6 indicate the possibility of seismically induced settlement and liquefaction at this site, generalized maps of this kind are notoriously conservative. As indicated by Figure 3, and confirmed by our borings, the site is underlain by alluvial fan deposits. There is no historic precedent in the Bay Area for liquefaction in such deposits, although clean sands from basal channel or overbank deposits which could be susceptible to liquefaction, may be present. In the absence of such clean sand deposits, we conclude that the liquefaction potential at the site, under extreme earthquake loading, is low, and negligible with regard to any effect being realized at the surface.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Based upon the results of our exploration, it is our opinion that the property may be rendered suitable for the proposed improvements. The building site consists of deep alluvial deposits that offer complex bearing characteristics for structural support of the proposed two new buildings. The existing building that is designated to receive a structural addition and the adjacent Temple building, have a satisfactory 20-year-plus, records of performance. Nevertheless, from a geotechnical engineering perspective, it will be necessary to design the foundation support with careful consideration to the potential for vertical displacements as a result of highly expansive near surface soils, and settlement due to relatively soft characteristics of the underlying soils.

Standard professional practice, demands that the proposed structural addition foundation, match the existing foundation system that supports the Assembly Hall building. Based on the information provided to this office from the subject building's Structural Engineer of record, the existing building derives support from a pier and grade beam foundation with floating slab-on-grade interior floor space. As such, design recommendations are provided herein for the design of a pier and grade beam foundation to support the proposed structural addition. However, due to a potential for pier hole wall collapse during drilling and the obstruction posed by the existing improvements to adjust the exterior grades to promote drainage, detailed recommendations are provided in the following section of this report, for contingencies to mitigate the effects of these adverse conditions.

The proposed two, new buildings, will require building pad preparations and relatively heavy mat type foundations, to mitigate the effects of the highly expansive soils and settlement related issues.

In order to avoid saturation of foundation bearing soils, resulting from surface flows, the site drainage must be planned so that the foundations are not allowed to saturate, and no ponding of water takes place near the foundation. The detailed recommendations for foundation design criteria, and other pertinent considerations, are presented in the following sections of this report.

The recommendations presented in this report, are for the soil conditions encountered during our exploration. Should other soil or rock conditions be uncovered during construction, due to non-uniformity of the geological formations, we should be contacted to evaluate the need for revision of the recommendations presented herein.

5.2 SEISMIC DESIGN

Based on the results of our investigation, we recommend that the following seismic design criteria be implemented in accordance with the California Building Code (2007):

Site Class	D
F_a	1.0
F_v	1.5
S_{ds}	1.20
S_{d1}	0.67

5.3 SITE PREPARATIONS

While no mass grading is anticipated for the future improvements, it may be desirable to raise the grades in the areas designated to receive structural improvements, to promote drainage and achieve uniformly compacted pad grades.

The pad locations for the future two new buildings are presently covered with gravels as they have served as parking areas. The existing gravels, constitutes an acceptable surface to receive fill materials. Nevertheless, it is recommended that the surface soils within areas designated to receive foundation improvements, be scarified, and moisture conditioned as necessary, prior to being compacted, as directed in the field by our Engineer. The resulting grade should produce a surface that slopes away from the future building perimeter, to act as a barrier to infiltrating surface waters. Compaction testing of the scarified and compacted surface will not be practical, due inaccuracies that can be anticipated as a result of a non-uniformity of the mixture of the native and imported materials. Subsequently, it is recommended that a minimum of 18-inches of Class II Baserock be provided to raise the pad grades relative to the surrounding future parking subgrade, to promote drainage and a firm pad subgrade. The Baserock should be compacted to 90% of the maximum dry density, based on ASTM Test Procedure D1557.

The areas designated to receive the structural additions to the existing Assembly Hall building, should be scarified and moisture conditioned to attain a moisture content between 2 and 4 percent above the optimum moisture content, in preparation for the administration of compaction efforts intended to accomplish between 85 and 90% of the maximum dry density, based on ASTM Test Procedure D1557.

All grading operations must be under the supervision of an Engineer from this office, in addition to the compaction testing procedures conducted by a Field Technician.

5.4 FOUNDATION RECOMMENDATIONS

5.4.1 Additions to Assembly Hall Building

It will be required to match the existing building foundation with the construction of drilled, cast-in-place reinforced concrete piers.

It will be necessary for the piers to be structurally integrated by grade beams, and to the existing building foundation, so that they act as a unit. Structural loads should determine pier spacing. The grade beam design should attempt to minimize the beam width to reduce the area that may be subjected to upward soil expansion pressures. The following table summarizes our recommended criteria for foundation design:

FOUNDATION DESIGN CRITERIA

Pier Diameter	Minimum 12-inches.
Pier Spacing	Minimum 3 pier diameters. Maximum 8-feet, center to center.
Pier Depth	Minimum of 25-feet, or as determined in the field by a representative from this office, during drilling.
Bearing Capacity	Maximum friction value of 200 psf commencing three feet below the lowest adjacent grade. These values may be increased by 1/3 for wind and seismic loads. Pier depths of 30-feet, should be anticipated.
Grade Beams	Minimum reinforcement of two No. 5 bars, both top and bottom. Maximum width 10-inches.

The piers should contain steel reinforcement over their entire length, with reinforcement as directed by the project Structural Engineer. Resistance to lateral forces transmitted to elements of the foundation can be computed assuming a passive resistance that commences at the top of the piers, equivalent to that caused by a fluid weighing 250 pcf. The passive force may be assumed to have a tributary horizontal width equal to 1-1/2 pier diameters. In no case, however, should these piers contain less than four No. 5 reinforcing bars, with two bars tied to the top steel bars in the grade beam.

The settlement of piers is estimated to not exceed 0.5 inch when properly constructed, both as to depth of bearing and proper clean-out prior to placement of concrete. When ground water is encountered, a tremie should be used to place concrete in the pier holes. The procedure should begin by placing

concrete with the tremie hose at the bottom of the excavation, and "floating" the water above the concrete until uncontaminated concrete flows out of the top of each hole. Due to the potential for caving or sloughing, contingencies should be made to place the reinforcing steel and concrete as soon as practical, following the pier excavations.

The interior floor space should implement slabs-on-grade that have the ability to float. Complete isolation of the floor from bearing walls, columns, nonbearing partitions, stairs, and utilities, should be provided to allow the slab to move with minimum damage to the structural integrity of the building. A flexible felt joint should be provided between the grade beam and the slab, to fill the void and prevent moisture infiltration.

All slabs should be a minimum thickness as set forth by the Structural Engineer, but should not be less than 5-inches thick, and reinforced by a minimum of No. 4 bars, spaced at 18-inches each way, and centered within the entire slab.

Concrete slabs should include crack control joints for normal lineal shrinkage of the concrete materials. Where large areas of concrete slab are placed, with irregular projections or inserts within the slab area, stress concentrations will result, causing uncontrolled crack patterns. Where possible, crack control joints should be placed at stress locations where projections from a main slab, or where inserts occur, in order to control the resultant crack pattern.

All concrete slabs-on-grade should be underlain by a 4-inch thick capillary break of "pea gravel" or clean crushed rock (no fines). It is recommended that Class 2 baserock not be employed as the capillary break material. To mitigate vapor transmission, it is recommended that an impermeable membrane of 10-mil minimum thickness be placed upon the capillary break material, and overlain by 2-inches of clean sand, to assist in proper curing of the slab.

5.4.2 New Building Foundations

Geotechnical conditions demand a foundation system designed to resist the effects of highly expansive soils. We recommend that the design procedures outlined in the Uniform Building Code (2001), Section 1815, be implemented, to design a structural mat foundation system.

Based upon an assumed climatic rating of 15 and effective plasticity index of 30, a soil/climatic rating factor of .17 can be assigned. Based on the soil/climatic rating factor of .17, a cantilever length can be obtained from Figure 18-III-6, as L_c = 6-feet. As such, it is recommended that the slab be designed with an ability to cantilever a distance of 6-feet.

The exterior edges should be at least 12 inches in width and have their bases located no less than 24 inches below the lowest adjacent finished subgrade. Isolated interior footings may have their depth reduced to 18 inches below the lowest adjacent subgrade.

Exterior edges should contain steel reinforcement over their entire length, with reinforcement as directed by the project Structural Engineer. In no case, however, should the exterior edge contain less than two No. 5 reinforcing bars, both top and bottom. Exterior edges constructed to the given criteria, may be designed for an allowable bearing capacity of 1,500 psf for dead load, and 2,000 psf dead load plus live load condition. These values may be increased by one-third to accommodate short duration seismic or wind loading conditions.

All concrete slabs-on-grade should be underlain by a 4-inch thick capillary break of "pea gravel" or clean crushed rock (no fines). It is recommended that Class 2 baserock not be employed as the capillary break material. To mitigate vapor transmission, it is recommended that an impermeable membrane of 10-mil minimum thickness be placed upon the capillary break material, and overlain by 2-inches of clean sand, to assist in proper curing of the slab.

5.5 DRAINAGE

It is important to divert surface run-off away from the foundation perimeter. A slope gradient of 3 percent down and away from the building perimeter, for a minimum of 5 feet, should be provided to the finish grade. Downspouts should be connected to conduits that will transport their effluent to a discharge point away from structural element-bearing soils. Adjacent areas should be slopped toward area drains that are designated to low points.

Due to physical and grade restrictions affecting the existing Assembly Hall Building, modifications to the exterior grades to promote drainage would be burdensome. As such, we recommend that a perimeter subdrain be provided along the exterior of the entire building. The subdrain trench should extend into the underlying dark-brown clay topsoil and slope at a minimum of 1 % toward a discharge into the storm system. A 3-inch diameter, rigid, perforated pipe with perforations facing down, should then be placed at the base of the trench and the pipe slope verified. The trench should then be backfilled with Class II Permeable Rock material.

5.6 UTILITY TRENCHES

Utility trenches that are parallel to the sides of the slab edges, should be avoided. All trenches should be backfilled with native materials compacted uniformly to a 90% relative compaction.

5.7 PAVEMENTS

The pavement section for the driveway and parking areas should be no less than 2.5-inches of Asphaltic Concrete over 9-inches of Class II Aggregate Baserock, in accordance with the previous Geotechnical Study by Consolidated Engineering.

The performance of the final pavement will depend upon the quality of workmanship and materials. The following summarizes the recommended construction procedure to be followed:

1. Scarify the subgrade surface to a minimum of 6-inches, to properly moisture condition the soil to 2 to 5 percent above the optimum moisture content, and compact it to between 88 and 92 percent of maximum dry density.

2. Provide the necessary gradient to prevent the ponding of water.

3. Place the baserock in lifts that are within the compaction capabilities of the compaction equipment, and compact to 95 percent of maximum density.

4. Place the Asphaltic Concrete during fair weather only, and at a temperature within its' prescribed limits.

6.0 GENERAL CONDITIONS

6.1 PLAN REVIEW

Prior to the submission of design drawings and construction documents for approval by the appropriate local agency, copies of these documents should be reviewed by our firm, to evaluate whether or not the recommendations contained in this report, have been effectively incorporated into the design of the project.

6.2 CONSTRUCTION OBSERVATIONS

A representative of this firm must be present during grading of the site. This item is necessary to properly evaluate the quality of the materials and their relative compaction. Foundation excavations must be inspected by a representative of this firm, in order to make the necessary adjustments as a result of localized irregularities.

At the completion of the earthwork related construction, a report will be submitted summarizing our observations, including the results of the compaction testing program.

To allow for proper scheduling, we request a minimum of 48 hours notice prior to the commencement of earthwork operations requiring our presence.

6.3 LIMITATIONS

This report has been prepared by HENRY JUSTINIANO & ASSOCIATES for the exclusive use of the Hindu Community Cultural Center Administrators, and their representatives, for consideration of the proposed improvements to the property described in this report.

The interpretations and recommendations presented in this report, are professional judgements and are based on our evaluations of the technical information obtained during this investigation, on our understanding of the characteristics of the planned improvements, and on our general experience with similar subsurface conditions in other areas. We do not guarantee the performance of this project in any

respect, only that our engineering work and judgements meet the standards of care normally exercised by our profession.

It is assumed that the borings are representative of the subsurface conditions throughout the areas designated to receive improvements. Unanticipated soil conditions are commonly encountered and cannot be fully determined by performing exploratory borings. If, during construction, subsurface conditions different from those indicated in this report, are encountered or appear to be present beneath excavations, HENRY JUSTINIANO & ASSOCIATES should be advised at once, so we can review these conditions and reconsider our recommendations, when necessary.

If more than 18 months have elapsed between the submission of this report and the start of work at the site, or if conditions have changed because of natural causes or construction operations at or adjacent to the site, we recommend that this report be reviewed to determine the applicability of the conclusions and recommendations, considering the time lapse or changed conditions.

The scope of our services did not include an environmental assessment, or an investigation of the presence or absence of hazardous, toxic, or corrosive materials, in the soil, surface water, groundwater, or air, on, below, or around this site.

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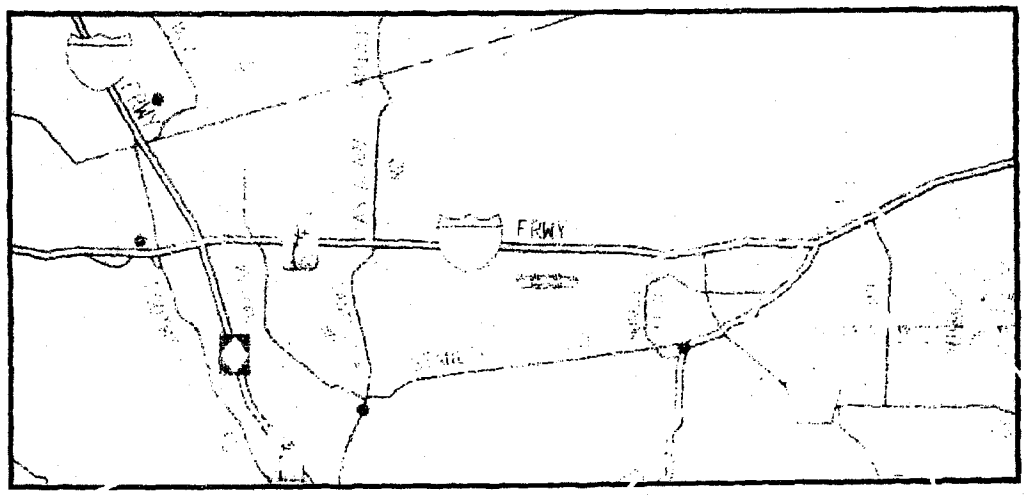
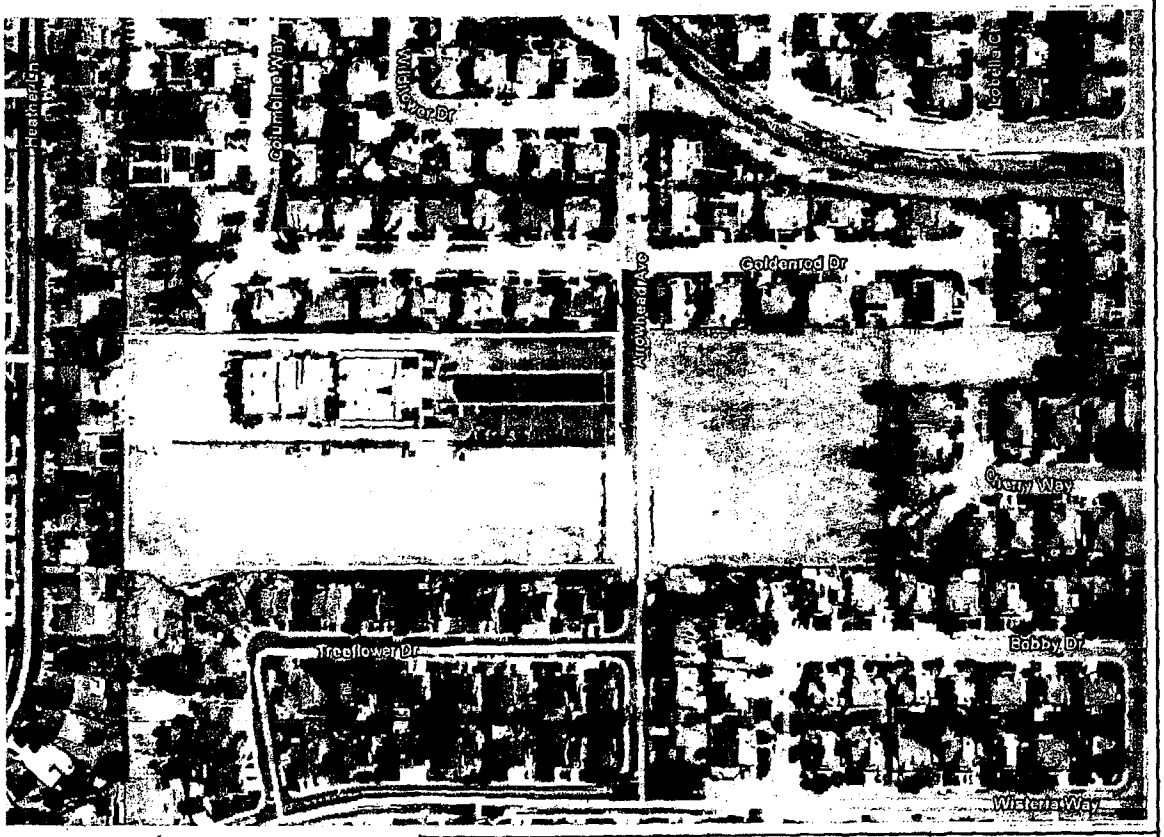




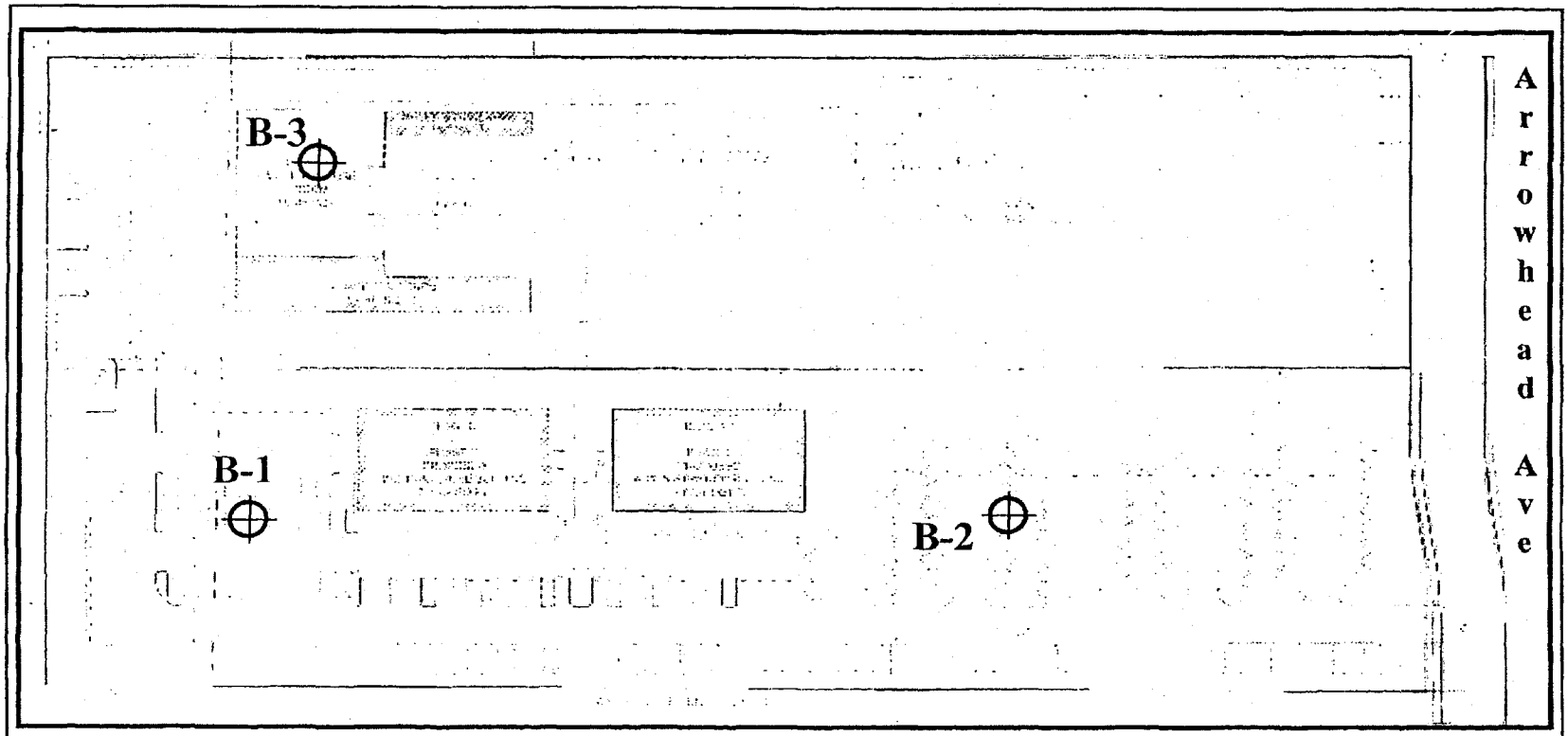
SITE LOCATION

Source: Thomas Guide, 2003
Google Earth

Project No.: H-140-01	Date: 08-10-09	Scale: NTS

Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 1



SITE PLAN

N

Explanation

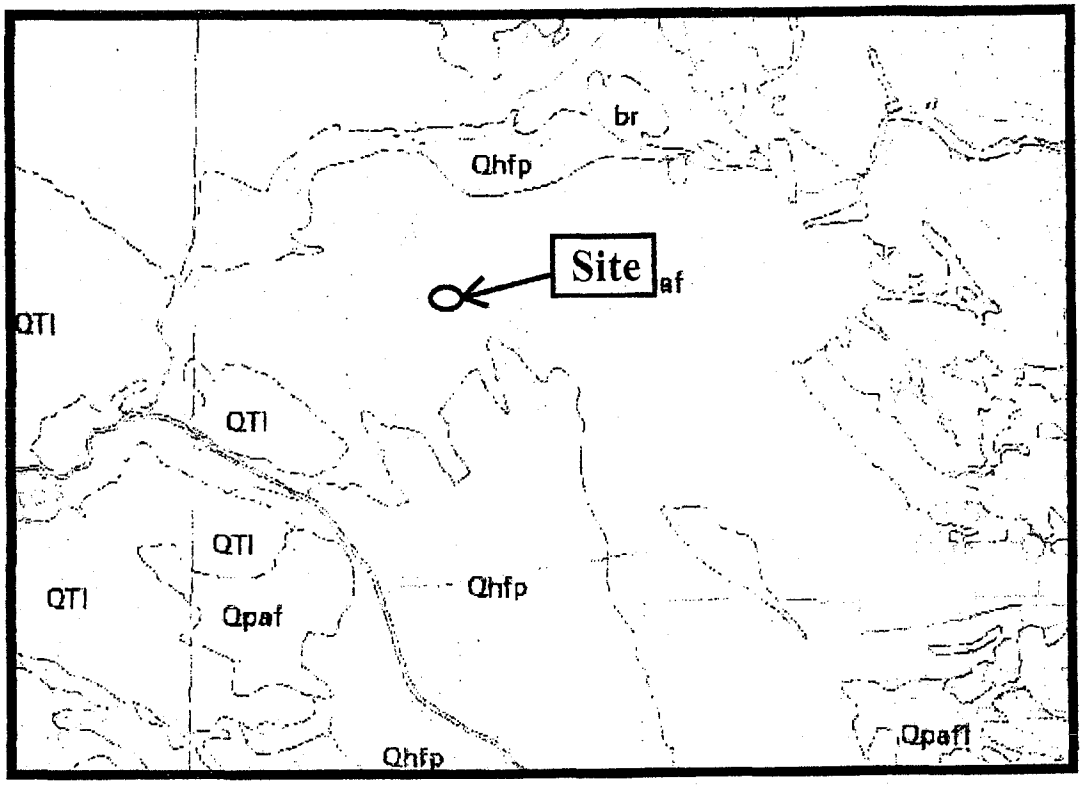
⊕ Approximate Borehole Location

Source: DeBolt Civil Engineering

Project No. : H-140-01	Date: 08-10-09	Scale: NTS

Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 2



EXPLANATION

Qhfp –Floodplain deposits (Holocene)

Qpaf –Alluvial Fan deposits (Pleistocene)

Qpafl –Alluvial Terrace deposits (Pleistocene)

QTl –Livermore gravels (Pleistocene and/or Pliocene)

GEOLOGY MAP

E. J. Helley and R.W. Graymer, 1997

N

Project No.: H-140-01	Date: 08-10-09	Scale: NTS

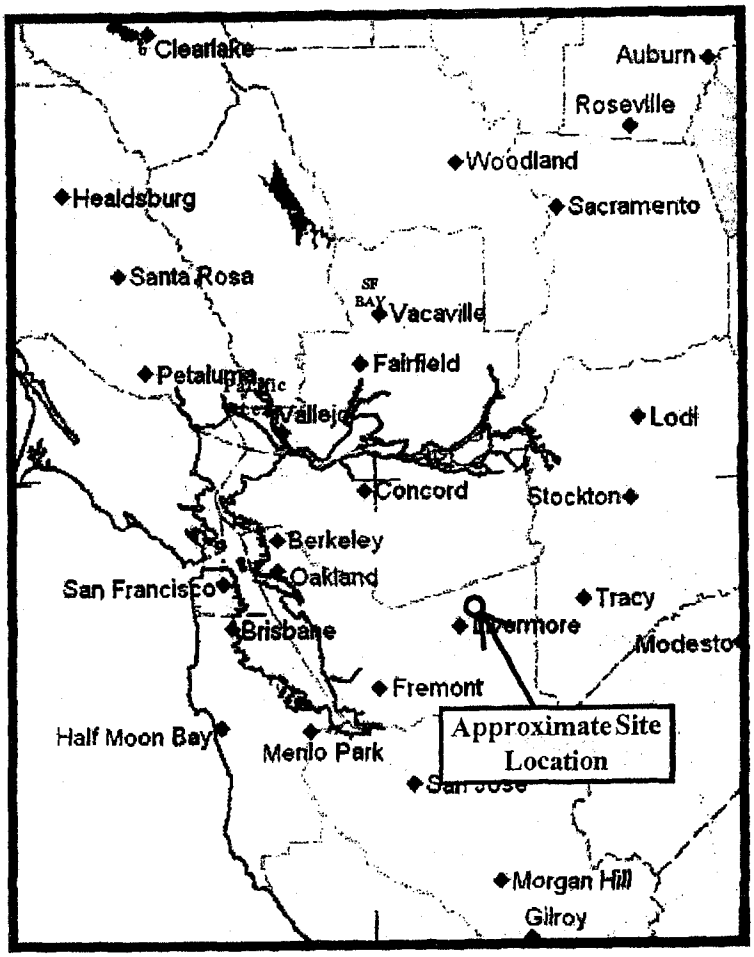
Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 3

Shaking (%g)
Pga (Peak Ground Acceleration)
Firm Rock

< 10%
10 - 20%
20 - 30%
30 - 40%
40 - 50%
50 - 60%
60 - 70%
70 - 80%
> 80%

The unit "g" is acceleration of gravity.



PROBABILISTIC SEISMIC HAZARD MAP
(Modified)

(10% Probability of Exceedance in 50 Years)
Peak Horizontal Ground Acceleration
Firm-Rock Site Condition

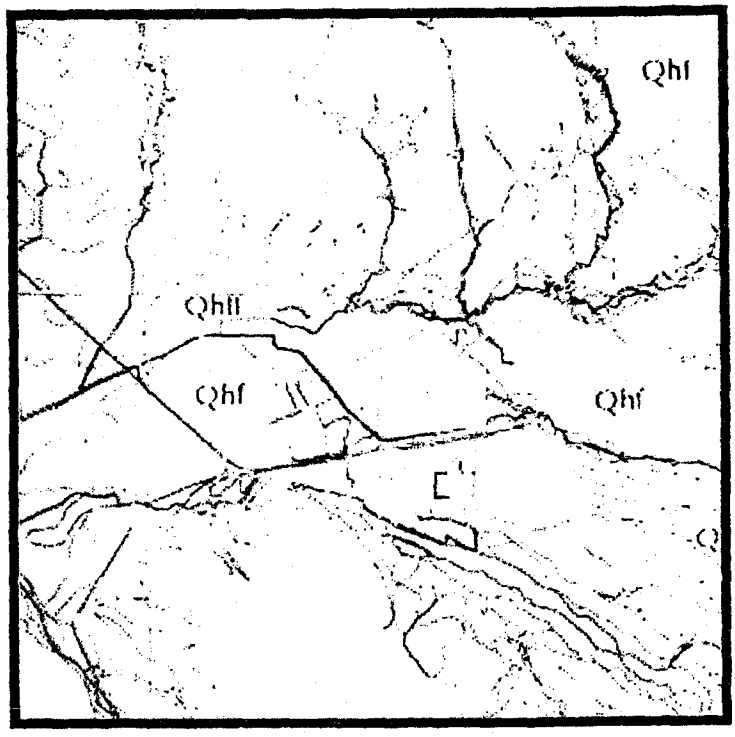
Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA)
(revised 2003)

N

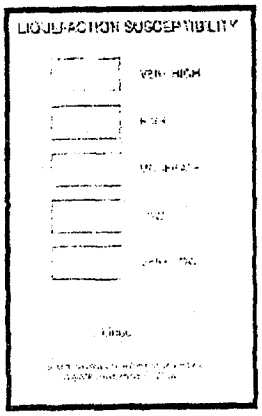
Project No. H-140-01	Date: 08-10-09	Scale: NTS

Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 4



EXPLANATION



MAPS OF LIQUEFACTION SUSCEPTIBILITY IN THE CENTRAL SAN FRANCISCO BAY REGION CALIFORNIA

R. C. Witter, K. L. Knudsen, J. M. Sowers, C. M. Wentworth, R. D. Koehler, and C. E. Randolph,

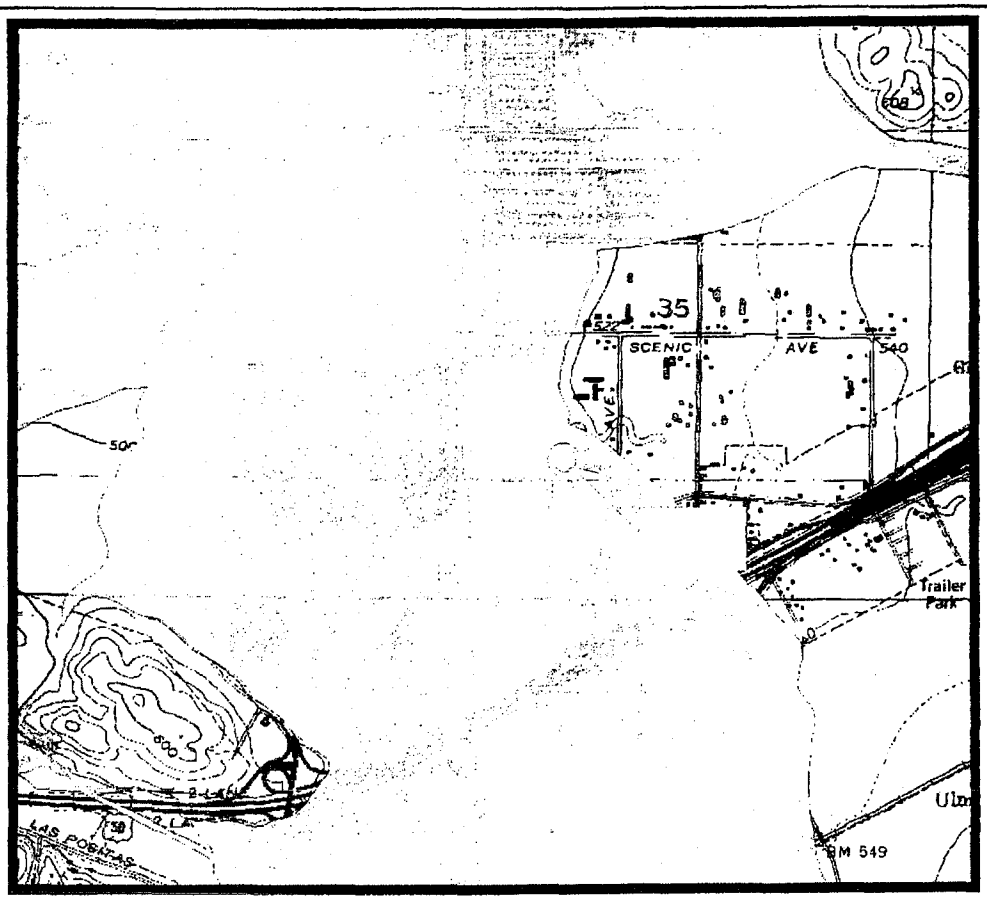
California Geological Survey, U.S. Geological Survey

2006

Project No.: H-140-01	Date: 08-10-09	Scale: NTS

Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 5



N

EXPLANATION

Liquefaction

Areas where historical occurence of liquefaction, or local geological, geotechnical and ground-water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

STATE OF CALIFORNIA SEISMIC HAZARD ZONES

ALTAMONT QUADRANGLE OFFICIAL MAP
RELEASED FEBRUARY 27, 2009 (MODIFIED)

Project No.: H-140-01	Date: 08-10-09	Scale: As Shown

Henry Justiniano & Associates
Soils and Foundation Engineering

Figure No. 6

Exploration Boring Log by:

Henry Justiniano & Associates

Boring Log No.: B-1
Project: Arrowhead
Client: Hindu Community Cultural Center
Date Drilled: 07/30/09
Equipment Used: Mobile Drill, 140 Lb., 30 inch Drive, 4" Continuous Flight, Sampler As Noted.
Location: 98' South, 132' East of Western Common Property Corner

Depth (in Feet)	Other Laboratory Tests	Dry Density (pcf)	Moisture Content %	Blow Count per 12 inch Drive	Sample Number & Type	Groundwater	Description of Material
							6" Gravel @ Surface
2	**Atterberg Limits** Liquid Limit = 51 Plasticity Index = 37		13.7	8	B-1-A SPT		Black-Grey, Silty CLAY Highly Plastic Moist, Medium Stiff to Stiff
			15.6	11	B-1-B SPT		Tan, Sandy CLAY Moist, Stiff
	Sieve		17.0	16	B-1-C SPT		Groundwater level after drilling 9-Feet Tan, Sandy CLAY w/1"-2" Sand Lenses
10							Moist, Stiff
	Atterberg Limits Liquid Limit = 29 Plasticity Index = 14 **Sieve**			10	B-1-D SPT		Tan, Clayey SAND Wet, Loose to Medium Dense
	Atterberg Limits Liquid Limit = 29 Plasticity Index = 13 **Sieve**		16.8	10	B-1-E SPT		Tan, Sandy CLAY Wet, Stiff
20							
	Atterberg Limits Liquid Limit = 34 Plasticity Index = 21 **Sieve**		15.3	13	B-1-F SPT		Tan, Sandy CLAY Wet, Stiff
	Sieve		15.0	24	B-1-G SPT		Tan, Sandy CLAY Wet, Very Stiff
30							
	Sieve		15.2	20	B-1-H SPT		Tan, Sandy CLAY Wet, Very Stiff
40							

Figure No. 7

Exploration Boring Log by:
Henry Justiniano
& Associates

Boring Log No.: B-1 Continued
Project: Arrowhead
Client: Hindu Community Cultural Center
Date Drilled: 07/30/09
Equipment Used: Mobile Drill, 140 Lb., 30 inch Drive, 4" Continuous Flight, Sampler As Noted.
Location: 98' South, 132' East of Western Common Property Corner

Depth (in Feet)	Other Laboratory Tests	Dry Density (pcf)	Moisture Content %	Blow Count per 12 inch Drive	Sample Number & Type	Groundwater	Description of Material
42							Tan, Sandy CLAY Wet, Very Stiff
				37	B-1-I SPT		Tan, Clayey SAND No Recovery Wet, Dense Terminated at 50 feet.
50							
60							
70							
80							

Figure No. 8

Exploration Boring Log by:

Henry Justiniano & Associates

Boring Log No.: B-2
Project: Arrowhead
Client: Hindu Community Cultural Center
Date Drilled: 07/30/09
Equipment Used: Mobile Drill, 140 Lb., 30 inch Drive, 4" Continuous Flight, Sampler As Noted.
Location: 98' South, 250' West of Eastern Common Property Corner

Depth (in Feet)	Other Laboratory Tests	Dry Density (pcf)	Moisture Content %	Blow Count per 12 inch Drive	Sample Number & Type	Groundwater	Description of Material
							3" Gravel @ Surface
2			12.6	13	B-2-A SPT		Dark Brown, Silty CLAY Highly Plastic Slightly Moist, Stiff
	Sieve		17.7	11	B-2-B SPT		Tan, Sandy CLAY Moist, Stiff
	Sieve		17.3	9	B-2-C SPT		Tan, Clayey SAND Wet, Loose to Medium Dense
10							Groundwater level during drilling 11-Feet
	Sieve		18.7	9	B-2-D SPT		Tan, Clayey SAND Wet, Loose
	Atterberg Limits Liquid Limit=42 Plasticity Index=25 Sieve		16.9	11	B-2-E SPT		Tan, Sandy CLAY Wet, Stiff
20							
	Sieve		15.9	17	B-2-F SPT		Tan, Sandy CLAY Wet, Very Stiff
	Atterberg Limits Liquid Limit=34 Plasticity Index=21 Sieve		12.1	24	B-2-G SPT		Tan, Sandy CLAY Wet, Very Stiff
30							Terminated at 30 feet.
40							

Figure No. 9

Exploration Boring Log by:
Henry Justiniano
& Associates

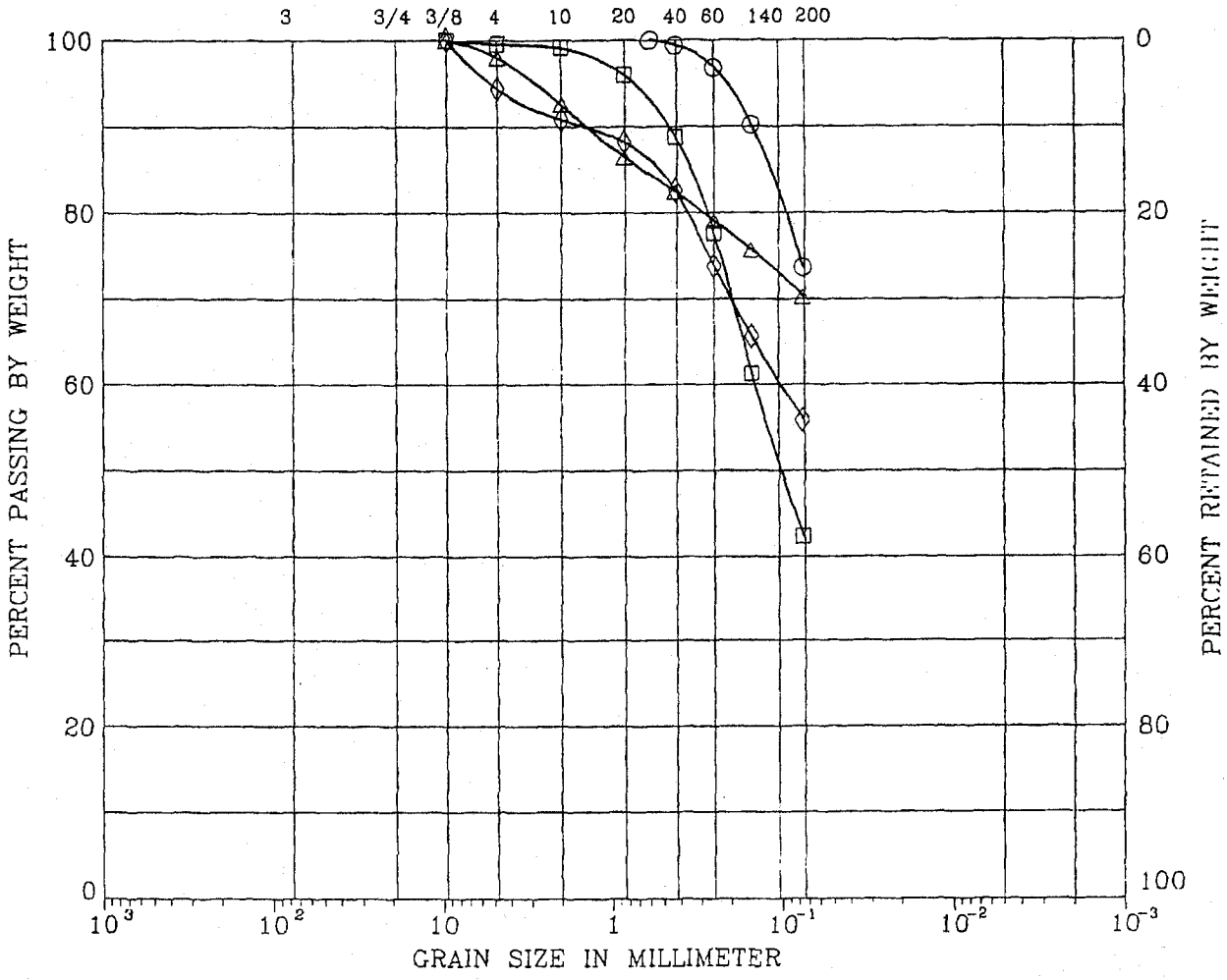
Boring Log No.: B-3
Project: Arrowhead
Client: Hindu Community Cultural Center
Date Drilled: 07/30/09
Equipment Used: Mobile Drill, 140 Lb., 30 inch Drive, 4" Continuous Flight, Sampler As Noted.
Location: 18' South, 50' West of Northwestern Corner of Western Existing Building

Depth (in Feet)	Other Laboratory Tests	Dry Density (pcf)	Moisture Content %	Blow Count per 12 inch Drive	Sample Number & Type	Groundwater	Description of Material
2	**Atterberg Limits** Liquid Limit=33 Plasticity Index=20		12.6	13	B-3-A SPT		Dark Brown, Silty CLAY Highly Plastic Moist, Stiff
			17.3	9	B-3-B SPT		Tan, Clayey SAND Wet, Loose to Medium Dense
10							Groundwater level during drilling 10-Feet
	Atterberg Limits Liquid Limit=43 Plasticity Index=27 **Sieve**		18.7	9	B-3-C SPT		Tan, Sandy CLAY w/2" Sand Lense, Mid Sample Wet, Stiff
20							
	Atterberg Limits Liquid Limit=34 Plasticity Index=17 **Sieve**		16.9	11	B-3-D SPT		Tan, Sandy CLAY Wet, Stiff
	Sieve		17.7	11	B-3-E SPT		Tan, Clayey SAND Gravelly Sand Layer @28.5-29 Wet, Loose Terminated at 30 feet.
30							
40							

Figure No. 10

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



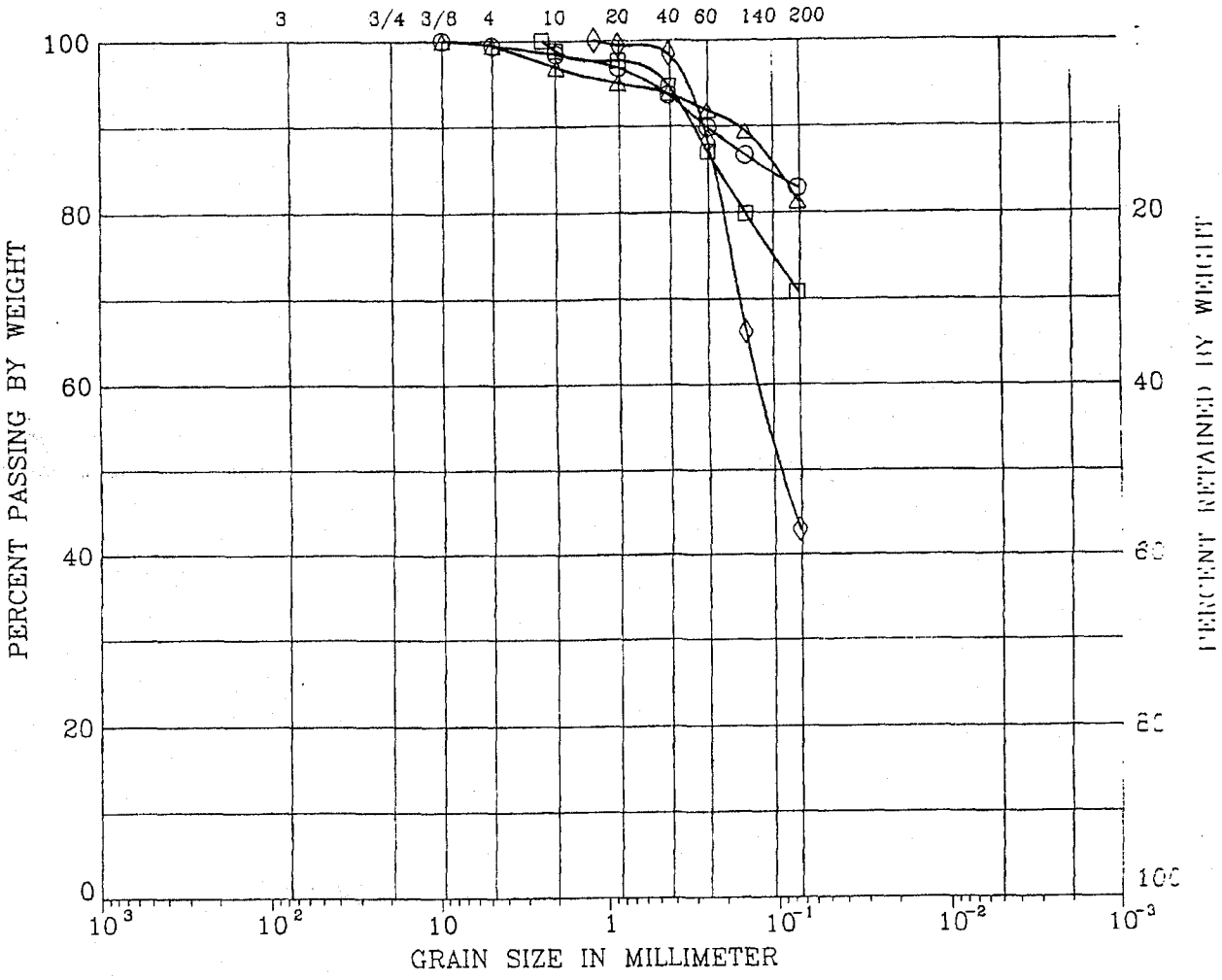
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	B-1-C	8.5-10			INORG. SILTS AND CLAYS (ML-CL)
□	B-1-D	13.5-15	29	14	CLAYEY SAND (SC)
△	B-1-E	18.5-20	29	13	INORGANIC CLAYS (CL)
◇	B-1-F	23.5-25	34	21	INORGANIC CLAYS (CL)

Remark :

Project No.H-14001	Hindu Community Cultural Center
H. Justiniano And Associates	GRAIN SIZE DISTRIBUTION Figure No. 11

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



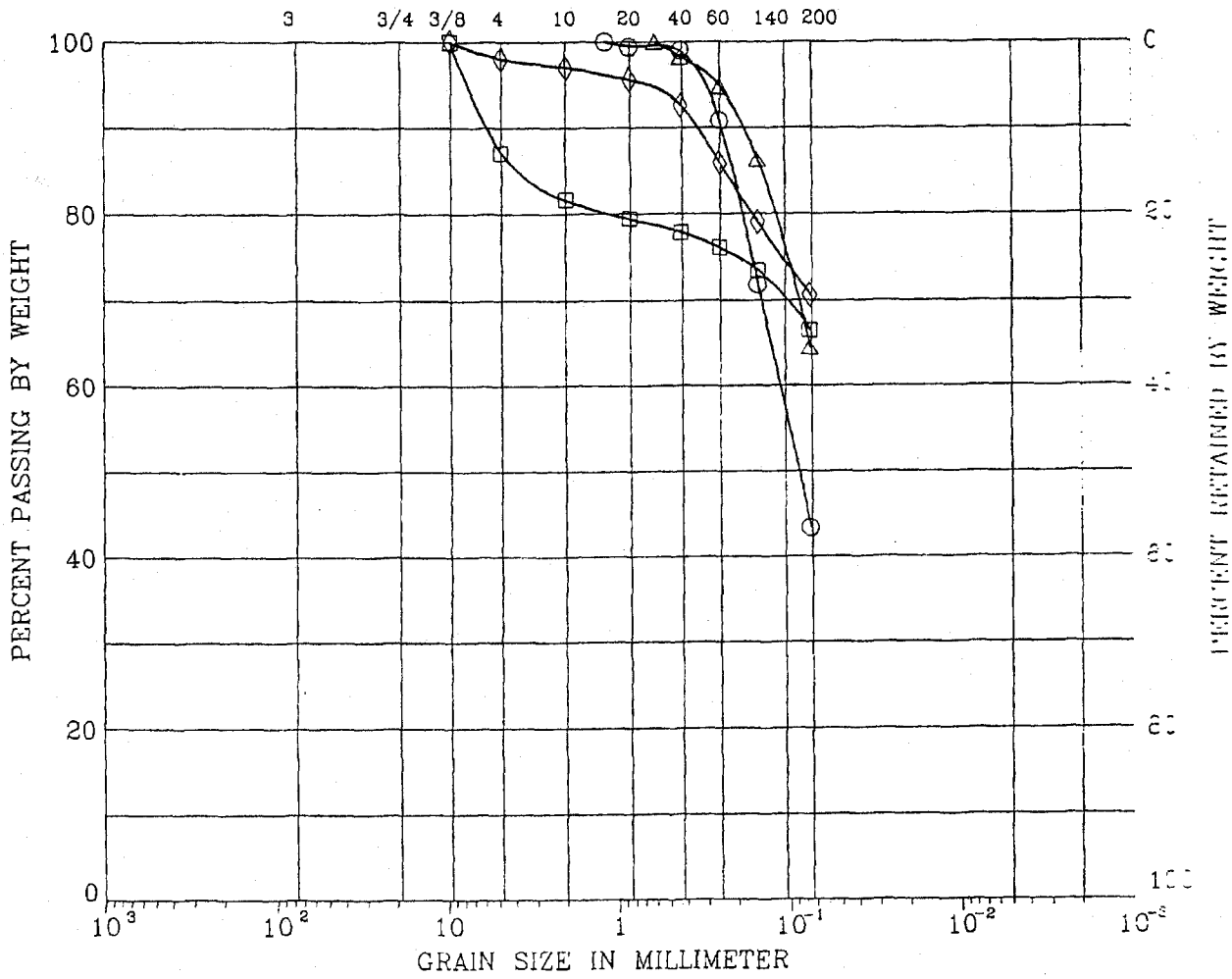
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	B-1-G	28.5-30			INORG. SILTS AND CLAYS (ML-CL)
□	B-1-H	38.5-40			INORG. SILTS AND CLAYS (ML-CL)
△	B-2-B	5-6.5			INORG. SILTS AND CLAYS (ML-CL)
◇	B-2-C	8.5-10			SILTY, CLAYEY SAND (SM-SC)

Remark :

Project No.H-14001	Hindu Community Cultural Center
H. Justiniano And Associates	GRAIN SIZE DISTRIBUTION Figure No. 12

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



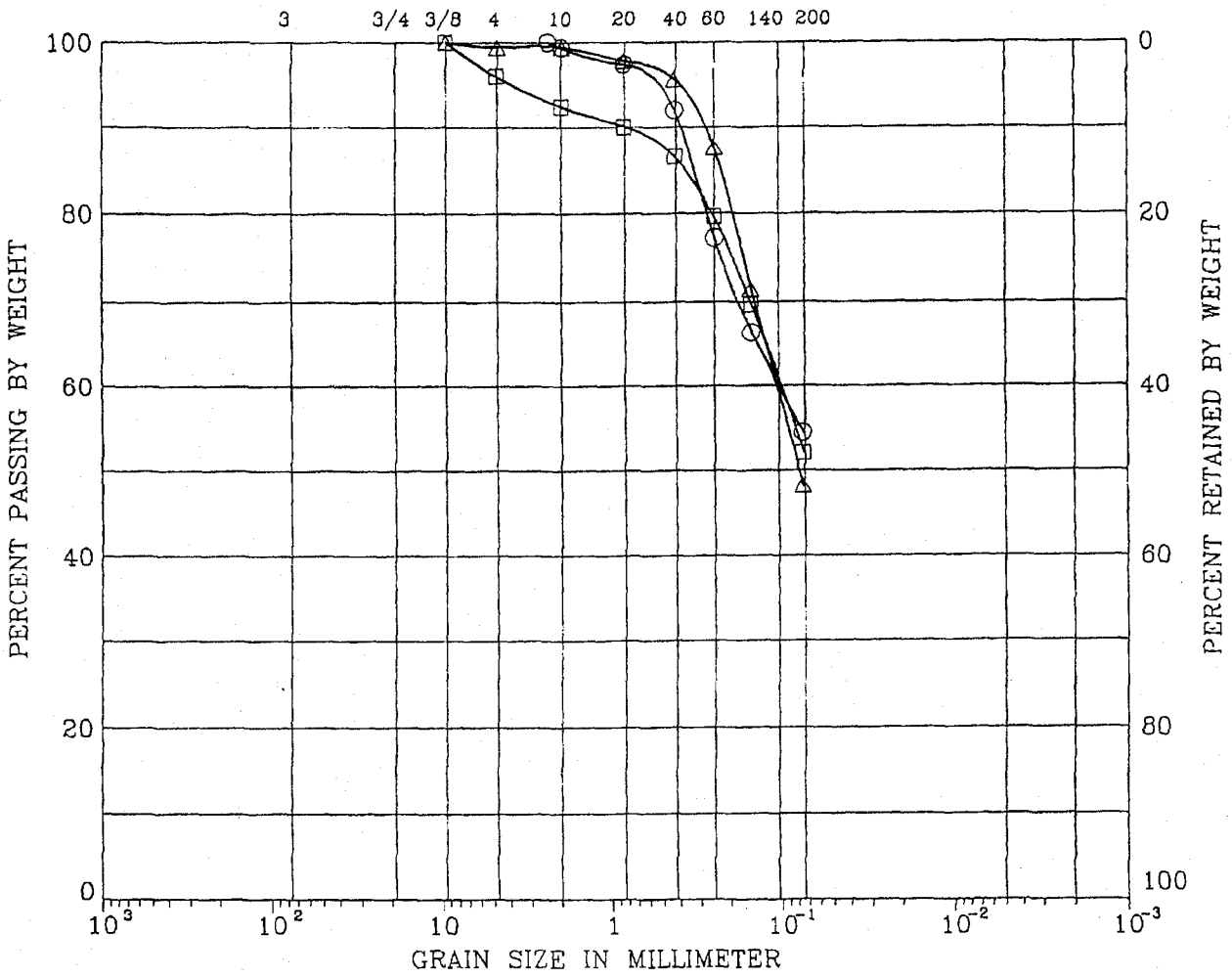
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	B-2-D	13.5-15			SILTY, CLAYEY SAND (SM-SC)
□	B-2-E	18.5-20	42	25	INORGANIC CLAYS (CL)
△	B-2-F	23.5-25			INORG. SILTS AND CLAYS (ML-CL)
◇	B-2-G	28.5-30	34	21	INORGANIC CLAYS (CL)

Remark :

Project No.H-14001	Hindu Community Cultural Center
H. Justiniano And Associates	GRAIN SIZE DISTRIBUTION Figure No. 13

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	B-3-C	13.5-15	43	27	INORGANIC CLAYS (CL)
□	B-3-D	23.5-25	34	17	INORGANIC CLAYS (CL)
△	B-3-E	28.5-30			SILTY, CLAYEY SAND (SM-SC)

Remark :

Project No.H-14001	Hindu Community Cultural Center
H. Justiniano And Associates	GRAIN SIZE DISTRIBUTION Figure No. 14

HENRY JUSTINIANO & ASSOCIATES
GEOTECHNICAL ENGINEERING

October 21, 2009
Project No. R-120-01

Hindu Community Cultural Center
1232 Arrowhead Avenue
Livermore, CA 94551

SUBJECT: PLAN REVIEW
Proposed Structural Additions
Hindu Community Cultural Center
Assembly Hall, Phase 1-A
1232 Arrowhead Avenue
Livermore, California

REFERENCES: GovindaRao & Associates, Foundation Plans and Supporting Structural Calculations for Hindu Community and Cultural Center, Project Arrowhead, Dated August 21, September 2, and October 19, 2009.

Henry Justiniano & Associates, Geotechnical Investigation, Proposed Two New Buildings and Structural Additions to Existing Building, 1232 Arrowhead Avenue, Livermore, California, Project No. H-140-01, Dated August 10, 2009.

Gentlemen:

In accordance with your request, we have reviewed the above referenced items in performance of this plan review for the proposed additions to the existing building, at the above subject Center. The purpose of our review was to determine if the foundation plans and supporting structural calculations have incorporated the geotechnical recommendations of the referenced soils report.

The plans indicate that the proposed foundation will derive support from 25-feet deep, 18-inch diameter piers. In estimating the pier capacity to carry vertical loads, the structural calculations have adhered to our recommended criteria. The plans designate pier reinforcement consisting of eight No. 5 vertical bars. Grade beam reinforcement will consist of two No. 5 bars, both top and bottom.

Slab-on-grade floors are designated 5-inch minimum thickness slab, reinforced by No. 4 bars at 12-inches on center each way. The slab will be underlain by 2-inches of sand, a moisture barrier, and 4-inches of gravel. A .5-inch felt joint is called for, at the grade beam/slab transition, as recommended.

The structural details call for the finished grade to have a 5 percent slope away from the building perimeter. Downspouts should be connected to conduits that will transport their effluent to a discharge

P.O. Box 2338 * San Ramon, CA 94583
(925) 831-9092 * FAX (925) 831-3716

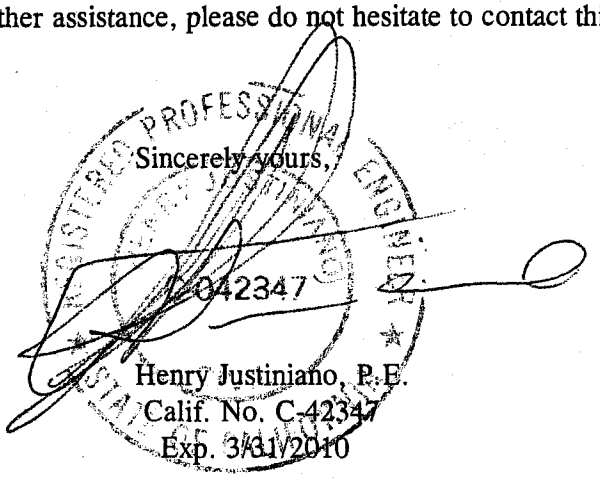
point away from structural element-bearing soils.

In summary, it is our opinion that the foundation plans and structural calculations have incorporated the recommendations prescribed by the soils report.

All grading and foundation drilling operations should be conducted under the supervision of our Engineer.

If you should have any questions or need further assistance, please do not hesitate to contact this office.

Sincerely yours,



Henry Justiniano, P.E.
Calif. No. C-42347
Exp. 3/31/2010

cc: Seven Hills (2)

HENRY JUSTINIANO & ASSOCIATES
GEOTECHNICAL ENGINEERING

May 28, 2010
Project No. R-120-01

Hindu Community Cultural Center
1232 Arrowhead Avenue
Livermore, CA 94551

SUBJECT: SECOND PLAN REVIEW
Proposed Trash Enclosure, Compost Area
Covered Walkways and Building C
Hindu Community Cultural Center
1232 Arrowhead Avenue
Livermore, California

REFERENCES: GovindaRao & Associates, Foundation Plans, Structural Details and Supporting Calculations for Hindu Community and Cultural Center, Phase 1-A, Trash Enclosure, Sheet S-5, Dated May 24, 2010; Phase 1-A, Compost Area, Sheet S-6, Dated May 24, 2010; Building C, Foundation and Roof Framing Plan, SheetS-1B, Dated March 12, 2010.

Henry Justiniano & Associates, Geotechnical Investigation, Proposed Two New Buildings and Structural Additions to Existing Building, 1232 Arrowhead Avenue, Livermore, California, Project No. H-140-01, Dated August 10, 2009. Plan Review, Proposed Structural Additions, Hindu Community Cultural Center Assembly Hall, Phase 1-A, Dated October 21, 2009.

Gentlemen:

In accordance with your request, we have reviewed the above referenced items in performance of this plan review for the proposed improvements to the above subject Community Cultural Center. The purpose of our review was to determine if the foundation plans and supporting structural calculations have incorporated the geotechnical recommendations of the referenced soils report.

The foundations for Building C, the trash enclosure and the compost area, are designed implementing mat foundations with thickened edges, in accordance with our recommendations. The slabs will be 9-inches in minimum thickness, with reinforcement consisting of two mats of No. 5 bars at 12-inches on center, each way, top and bottom. The structural computations arrive at the above-mentioned slab section by implementing the recommended capacity to cantilever 6-feet. All thickened edges will be a minimum of 12-inches in width, with the building having a minimum embedment of 24-inches, while the

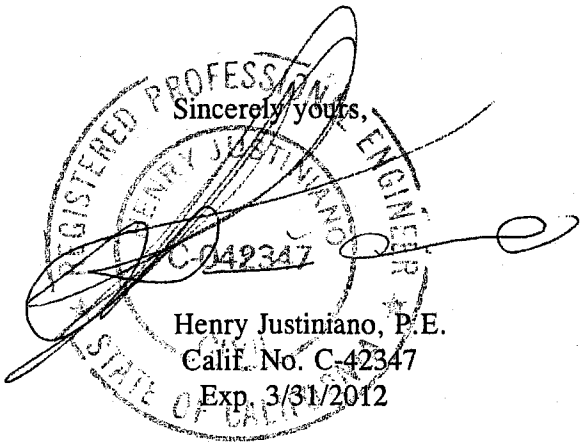
relatively lighter trash enclosure and the compost area slabs, will have their depth reduced to 22-inches, which is acceptable. The covered walkways will utilize a slab-on-grade that is designated with a 6-inch minimum thickness slab, reinforced by No. 5 bars at 12-inches on center each way. All slabs will be underlain by 2-inches of sand, a 10-mil moisture barrier, over a 4-inch layer of drain rock, except for the compost area, where the moisture barrier is rightly omitted.

We note that this office has been retained to observe all foundation excavations, in order to make any necessary adjustments, based on the conditions encountered.

In summary, it is our opinion that the foundation plans and structural calculations have incorporated the recommendations prescribed by the soils report.

If you should have any questions or need further assistance, please do not hesitate to contact this office.

Sincerely yours,



Henry Justiniano, P.E.
Calif. No. C-42347
Exp. 3/31/2012

HINDU COMMUNITY

AND

CULTURAL CENTER

Building D

Technical

Specifications

TECHNICAL SPECIFICATION

THIS TECHNICAL SPECIFICATION SUPPLEMENTS NOTES ON DRAWINGS AND INDIVIDULAL SPECIFICATIONS.

1.01 GENERAL CONDITIONS

The Contractor shall comply with the obvious intent and meaning of these plans and specifications, which shall be construed to include all material, measures and modes of work necessary to complete the work herein described in a workman like manner, in strict accordance with these plans and specifications and to the satisfaction of the Owner. Building shall be 100% watertight. For any problem questioning ability to warranty notify the architect. The Contractor shall be held responsible for and must make good any defects through faulty, improper or inferior workmanship arising or discovered in any part of his work within one (1) year after completion and acceptance of same. The Owner reserves the right to reject any or all bids without explanation of any kind.

1.02 ORDINANCES AND SUBCONTRACTORS

The Contractor shall procure and pay for all civil inspections, permits and certificates of inspection as required. It shall be the Contractor's responsibility to see that all subcontracted work includes everything the plans and specifications call for in the subcontracted scope of work. Each Contractor will be responsible for conformance of his work with all rules, regulations, ordinances and codes or regulatory agencies affection his work, whether or not shown in the plans and specifications, including all applicable OSHA and California/OSHA orders.

1.01 INSURANCE

Fire Insurance: Owner shall, at his expense, have the entire work (less ground and foundations) insured from loss by fire with a policy made out to the Owner and Contractor as their interest may appear. The policy to run until work is finally accepted.

Liability Insurance: The General Contractor and the subcontractors shall maintain Workmen's Compensation Insurance as required by state laws. In addition, the Contractor shall show Certification of Insurance for Comprehensive General Liability Insurance Policy (with limits for bodily injury of $50,000 each

person/$100,000 each accident and with limits for property damage of $10,000 each accident or its equivalent).

Bonds: Contractor shall provide bonds, labor and material and performance, for 100% coverage.

1.04 EXAMINATION OF THE SITE

Contractor shall visit the building site and become familiar with existing conditions before submitting estimates. Failure to do so shall not constitute a cause for future complaint or claim for extra.

1.05 DRAWINGS AND SPECIFICATIONS

a. The drawings, which are a part of these specifications, show the necessary grading for the general construction for the building.

b. The drawings and specifications are to be considered as cooperative and any work of materials shown or mentioned in either one shall be executed as if they were shown or mentioned in both.

c. Figures shall have precedence over scaled measurements and details over general drawings.

1.06 INTERPRETATION OF PLANS

Neither the Contractor nor his workers, nor any subcontractor or supplier, shall make any assumptions as to the intent or meaning of these plans and specifications. The Architect will make all decisions regarding the intent and meaning of all details of this contract and the decision shall be final. Any information required to fully clarify the intent and meaning of all details shall be requested form the Architect prior to bidding. After a building contract is signed, the Contractor will not be allowed extra costs for any items of work shown on the drawings and not included in his bid.

1.07 ALLOWANCES

Allowances provided in this contract are to be used only for material cost in the fixture and hardware categories. Labor to install allowed materials is to be included in base bid.

1.08 CHANGE ORDERS

Amounts of extras of credits for changed items shall be agreed upon by the Owner and the Contractor and written authorization shall be issued to the Contractor before proceeding with the work. Charges for work done without this written authorization will not be accepted.

1.09 CLEANING

a. This Contractor shall remove all debris form the building site and in general keep the work as clear of rubbish as possible and upon completion, all shall be left "broom clean".

b. This Contractor shall have all glass and plumbing fixtures cleaned by professional cleaners.

1.10 TEMPORARY SERVICES

a. Water: The General Contractor shall pay for all water used in the construction of the building.

b. Temporary Power: Electric power used in construction – the Contractor shall pay for temporary connection and electricity used.

c. The General Contractor shall provide temporary Sanitation Facilities.

1.11 LITIGATION

See contract agreement between Owner and Contractor

1.12 LIENS

See contract agreement between Owner and Contractor

1.13 INSPECTON

See drawings for required inspections.

1.14 FEES

Unless specifically excluded on the drawings, the Contractor shall pay for all permits and connection fees to local utilities companies and districts for connections of utilities and include all utilities fees, assessments, costs whatsoever in contract.

DIVISION 2 SITE WORK (see full specifications in site development drawings)

2A.01 DEMOLITION

See drawings for demolition.

2A.02 INSTALLATION

Install new curb and gutter and driveway work, where shown on drawings, in full accordance with City of Livermore standards and requirements.

2A.03 PERMITS

Obtain and pay for encroachment of other permits required for this work, and all related inspections.

2B.01 ON SITE IMPROVEMENTS

Cooperation with other trades. Prior to demolition, coordinate schedule with paving, electrical and irrigation subcontractors to allow their removal of materials to be relocated.

2B.02 DEMOLITION

See drawings for site demolition.

2B.03 CLEARING AND GRUBBING

See drawings for site clearing and grubbing.

2B.04 TRENCHING AND BACKFILL

See drawings for trenching and backfill.

2B.05 DUST CONTROL

During all stages of excavation and grading, provide labor and equipment to minimize drifting or blowing dust. Use dust control measures such as water spraying.

2B.06 PAVING

Before paving, etc. level off and compact rockfill to 95%.

Paving shall be 2" of plant mix applied on 4" Class II aggregate base crushed rock rolled flat with 10 ton rubber-tired roller, hand finished as required for first quality job. No pools of water permitted. All paving to be of material and workmanship specified for Type II Paving, California State Highway Department and AASHO Standards for Medium Traffic. All paving shall slope to drain. Apply Fog-seal coat after compaction of base or AC.

2B.07 STRIPING

Use lettering for compact stalls, arrows, symbols and curb at handicap stalls. Traffic paint white, blue accents, brush, spray or roller apply, 4" width unless noted otherwise.

2B.08 PARKING BUMPERS

Where shown, apply with epoxy and rebar pins to pavement. Bumpers to be minimum 6" high, of length shown, minimum 3,000 PSI concrete reinforced continuous length of the bumper.

2C.01 LANSCAPING AND IRRIGATION

See landscaping specifications attached.

DIVISION 3A CAST-IN-PLACE CONCRETE

Also see structural specifications on sheet SD-1.

3A.01 SCOPE OF WORK

Provide and install all concrete, reinforcing and forms conforming to shape, lines and dimensions shown on the drawings.

3A.02 CONCRETE

Portland cement shall be Type I or Type II.

Coarse aggregate shall not exceed the following size limits:

For Slabs: ¾" slump maximum 4"

For Walls and Footings: 1 – ½" slump maximum 4"

Transit mixed concrete shall have a minimum of six (6) sacks of cement per cubic yard. No admixtures or water shall be added to cement prepared to this specification without Architect's permission. Provide continuous inspection by testing lab of all concrete over 3,000 PSI. Submit mix design to Architect.

3A.03 CONCRETE SLABS

Before concrete slab on aggregate base is laid, lever off and compact rock fill to 95% compaction. See Section 2B. Reinforced concrete slabs, place in center of slab. Finish by screening, floating and troweling concrete to a smooth dense finish. See drawings for special finishes. Slope to floor drains where shown. Exposed concrete floors shall be suitably finished. Slabs shall be sealed and finished with "Stanlux Con-trete" as manufactured by Standard T. Chemical Company.

3A.04 CONCRETE FORMS

Forms shall be of wood, steel or other approved material. All forms must be true to line, plumb and level with joints fairly tight.

3A.05 REINFORCEMENT

Reinforcement shall be deformed structural grade billet steel conforming to ASTM Specification A165-40, latest designation or A165-60.

DIVISION 4 MASONRY

4A.01 SCOPE OF WORK

See structural specifications on sheet SD-1.

DIVISION 5 METALS

5A.01 SCOPE OF THE WORK

Furnish and install all structural steel and miscellaneous iron shown on the drawing.

5A.02 STRUCTURAL STEEL

All structural steel shall be fabricated and erected in accordance with the latest specifications of the AISC.

5A.03

Furnish all carpentry bolts, steel angles, clips and railings, etc. as shown and required.

5A.04 MATERIALS

See structural specifications on sheet SD-1.

a. Structural Steel
b. Paint
c. High strength bolts

Section 5B ARCHITECTURAL METAL

5B.01 WORK INCLUDED

a. Chain link fencing
b. Stair railing
c. Ornamental metal railings
d. Ladders. O-Keefe metal railings as noted on the drawings.
e. Submit Shop Drawings for all rails.

DIVISION 6 CARPENTRY

6A.01 SCOPE OF THE WORK

All rough, finished carpentry and millwork, installation of finish hardware and related items as shown and / or specified herein.

6A.02 MATERIALS

Lumber: Grade lumber in accordance with current grading rules #16 of the WCLA

Plywood: Grade in accordance with Commercial Standards. CS-45-48
(see specs on structural drawings, sheet SD-1)

6A.03 UNDERLAYMENT

6A.04 FRAMING

Frame, brace, anchor and tie all members together in a rigid manner. Make cuttings full and square. Do not cut structural members without Engineer's approval.

All members shall be securely nailed in place with proper size nails and secured rigidly in place. Studs shall be 16" on center, doubled at corners, partitions and sides of openings. Finish and install all rough hardware and install steel angles and bolts required and finished in Section 5A. Receipt and install all finish hardware accurately and neatly. All work to conform to the 2007 CBC.

6A.05 TRUS-JOIST

Trus-joist, where shown, shall be as manufactured by Trus-joist MacMillan Company, Inc. or approved equal. Trus-joists and all work attached thereto shall be installed in strict accordance with manufacturer's instructions and details. (see specification on structural drawings, sheet SD-1)

6A.06 GLU-LAMS

Glu-lams: Douglas fir in accordance with WCLA Standard Specifications, exterior glue. Industrial appearance end seal. Protect from moisture at all times prior to weather-tight building. (see specification on structural drawings, sheet SD-1)

DIVISION 6B - MILLWORK

6B.01 SCOPE OF THE WORK

DIVISION 7 - MOISTURE PROOFING

7A.01 SCOPE OF THE WORK

Provide and install all roofing as shown on the drawings and specifications herein. Install hot asphalt and two (2) 15# felt waterproofing on walls below grade and above finish floor lever. Slit and reseal all fishmouthes.

7A.02 MATERIAL AND WORKMANSHIP

Materials shall be new, furnished and installed in complete accordance with manufacturer's directions.

7A.03 ACCEPTABLE MANUFACTURERS

a. The Celotex Corporation

b. Johns-Manville Sales Corporation, Manville Building Materials Corp.

c. Owens-Corning Fiberglas Corp.

d. Consolidated Fiber Glass Products, Inc. (Conglas)

7A.04 MATERIALS (BASIS: Manville 4 ply, 10 yr. NDL)

a. Asphalt Bitumen and glass Fiber Reinforced Roofing: Manufacturer's standard products for systems specified and conforming to the requirements of NRCA Roofing Manual.

1. System: NRCA Specification 35-NAGM; nailable deck, asphalt glass fiber reinforced membrane with mineral cap sheet surfacing. (comply with NRCA requirements for each material)

2. Base Sheet: Provide three ply roofing system, counting base sheet, plus additional cap sheet.

3. Provide rosin-sized sheathing paper where recommended by roofing manufacturer for type of decking on project.

4. Base and Composition Flashing System: Provide manufacturer's premium quality commercial quality base and composition wall flashing system. (comply with NRCA recommendations)

b. Mineral Cap Sheet: ASTM D3909, Manufacturer's standard mineral surfaced cap sheet for type of roof specified.

1. Color: Silver grey or equal with a minimum of 78 solar reflection index, JM GlasKap CR Cool Roof or approved equal.

c. Walkway planks: Dek-top as manufactured by Asphalt Products Oil Corp. (415-542-4887) cut to sizes indicated on drawings for walkway planks.

d. Mechanical Fasteners: As recommended by insulation manufacturer and meeting recommendations of NRCA.

7A.05 PREPARATION

a. Inspect roof deck to ensure deck is clean and smooth, free of depressions, waves or projections and is properly sloped to drains, valleys or eaves.

b. Ensure roof openings, curbs and pipes, sleeves, ducts or vents through the roof are solidly set, cant strips are in place and nailing strips located.

c. Deck surfaces shall be dry.

7A.06 INSTALLATION

a. Apply roofing membrane in accordance with roofing manufacturer's instructions and NRCA recommendations for roof type specified.

b. Apply felts smooth, free from air pockets, wrinkles, fishmouths, prominent lap-joints or tears.

c. Carry felts up cant strips to vertical surfaces and secure to nailing strips.

d. Install 2-ply membrane and glaze coat for cut-off at "end-of-day" operation.

f. Coordinate metal flashings and counter flashing.

g. Coordinate installation of roof drains and related flashings.

h. Mop-in and seal flashings and flanges of items projecting through the membrane.

7A.07 GUARANTEE

The General Contractor and the Roofing Contractor shall submit a written statement guaranteeing all roof work for a period of ten (10) years from date of Acceptance. All roofing work to be certified by the manufacturer. Send two (2) copies of manufacturer's certificate to the Architect or Owner immediately upon completion of the work. Ten year, no dollar limit certificate required.

DIVISION 7A - SHEET METAL

7B.01 SCOPE OF THE WORK

Furnish and install all sheet metal work shown on the drawings, specified herein or wherever necessary for flashing purposes, to make a watertight job.

7B.02 MATERIALS

Galvanized iron: 26 gauge minimum

Solder: halfpig lead and half-tin with muriatic acid flux.

7B.03 WORKMANSHIP

Allow for expansion and contraction. Flash and counter flash all junctions of all roofs with vertical surfaces. Provide expansion joints 40'-0" on center. Fasten all down spouts securely to wall with straps. All workmanship shall be first class and shall be properly constructed and complete whether specifically mentioned or not. Use slip-joint covers at joints in flashing per SMACNA standards.

DIVISION 8 - DOORS, WINDOWS AND GLASS

For details see drawings and Title 24 requirements.

SECTION 8A - GLASS AND GLAZING

8A.01 SCOPE OF THE WORK

All glass is factory installed, under section 8D and 8E, except mirrors. Furnish and install glass wherever shown on the drawings. (per Flat Glass Marketing Association, Glazing Manual)

8A.02 MATERIALS

Clear glass: New clear float glass, PPG or equal ¼"
Tempered glass: New PPG herculite tempered safety glass
Bronze glass: New PPG solarbronze, min. ¼" pol. Plate
Plate glass: PPG or equal polished plate ¼" thick
Wire glass: ¼" polished, square mesh run vertical (not diagonal).
Mirrors: Type A – polished plate second silver quality (in each lavatory)
Unless noted on toilet accessory schedule.
Exterior Windows: Solarban 60 PPG Industries or approved equal.
Skylights: to be O'Keefs or equal double insulated. Frosted at restrooms.

8A.03 CLEANING

The General Contractor shall be responsible for thoroughly cleaning all glass on both sides and replacing all broken or cracked glass prior to acceptance of the building by the Owner.

8A.04 CODE

All work shall conform to the 2007 CBC regarding maximum size to thickness and tempering requirements.

SECTION 8B - FINISH HARDWARE

8B.01 SCOPE OF THE WORK

Contractor shall provide the Owner with complete Hardware Schedule for review and approval. Schedule shall include cross match-coding of locksets to door numbers on plans and three (3) copies shall be provided, allowing fifteen (15) working days for the Owner to review. Schedule shall show manufacturer's name and catalog number of each item. This schedule shall be considered the

Preliminary Schedule. (all hardware shall be commercial quality and shall be installed in accordance with CAC Title 24)

Contractor's hardware vendor shall prepare a revised/corrected schedule – revised document based upon the Owner's review comments on Preliminary Schedule. The revised document shall be considered the Final Hardware Schedule and three (3) copies shall be forwarded to the Owner. This will enable the Owner t prepare a Keying Schedule which will be forwarded through channels to the hardware supplier for ordering hardware.

8B.02 DOOR LOCKSETS

Door locksets shall be Sargent 8100 series LWIL with USS10B finish. Keyways and Pinning schedules shall be determined by the Owner to coordinate with the Master Keying Schedule. No substitution in liew of Sargent locks will be considered.

8B.03 KEYING

a. All keyed locks shall be passed by a Grand Master Key. All lock cylinders are to be Grand Mastered, sub-building mastered and set keyed.

b. Keys: Stamp all keys "do not duplicate"

1. Furnish three keys per lock with an additional three keys for each set; three keys for each Sub-master, three keys for each Building Master and 50 stamped key blanks in the Job Keyway.

2. Upon receipt of the locksets and cylinders from the factory supplier shall notify the Owner that the keyed locks and cylinders are ready to be checked for the keying requirements set forth in the Keying Schedule. After the keyed locks and cylinders have been checked against the Keying Schedule and corrections make the Owner will accept the keys for the job and the keyed locks will be delivered to the job.

8A.04 PANIC HARDWARE

Panic hardware and door closers shall be installed per the requirements of the local Fire Marshal. On all wood doors requiring panic bars and/or closers, such hardware shall be installed with hex bolts.

8B.04 DOOR BUMPERS

Door bumpers shall be Sargent concave type or equal. All wall mounted bumpers shall have solid backing (2x4) installed behind each bumper.

8B.05 DRAWER SLIDES

Drawer slides to be Knape Vogt 1280P

8B.06 BUTT HINGES

Butt hinges to be McKinney TA2724. 4 ½" x4 ½" typical.

8b.07 CABINET HINGES

Cabinet hinges: 30 deg. Reverse bevel doors – National Lock Co. C325

Cabinet Hinges: Flush doors – McKinney 2743

SECTION 8C - HOLLOW METAL DOOR FRAMES AND WINDOWS

8C.01 SCOPE OF THE WORK

Provide all ferrous metal doors and frames, hollow metal work and related items complete as shown and specified. All doors and frames to be shop coat primed, except pre-finished aluminum anodized doors and frames and timely pre-finished door frame systems. All exterior doors and frames shall be galvanized.

8C.02 MATERIALS

Hollow metal doors and frames shall be in accordance with Steel Door Institute (SDI) standard specifications. Interior Doors shall be SDI Level 2 (heavy duty), Model 1 (full flush). Exterior doors shall be SDI Level 3 (extra heavy duty) Model 1.

Interior door frames shall be SDI Level 2 (16 gauge heavy duty) and exterior door frames shall be SDI Level 3 (14 gage, extra heavy duty).

Fire-rated doors shall have UL Label with required rating.

SECTION 8E - METAL SASH

DIVISION 9A - PAINTING AND DECORATING

9A.01 SCOPE OF THE WORK

a. It is the intent of the specifications that the Contractor shall execute all painters finishes throughout the exterior and interior of the building. Paint all wood, plaster or sheetrock, unfinished metals, unless specifically noted otherwise. Spray texture all sheetrock for flatwall work.

b. Stipple all enamel. Provide smooth finish for areas with wallcoverings.

c. Accept tape work in writing to Owner, prior to start of painting.

d. Colors to be per Owner or as scheduled.

e. Workmanship to be first quality; smooth and uniform.

f. Protect the work of other trades.

g. Examine block for tightness and report defects to the Architect before starting.

h. Interior trim – two (2) coats of enamel over primer. Gypsum board – two (2) coats of latex over primer.

i. All paints to be Fuller-O'Brien or approved equal.

9A.02 EXTERIOR

a. Type A – Masonry/concrete: color coating – one (1) coat concrete block primer sealer and one (1) coat acrylic latex.

b. Type B – wood trim: one (1) coat oil primer and two (2) coats enamel.

c. Type C – Exterior ferrous metal: one (1) coat rust inhibiting primer and two (2) coats enamel.

d. Type D – Galvanized metal: one (1) coat of zinc dust – zinc oxide primer and two (2) coats semi-gloss enamel.

9A.03 INTERIOR

a. Type 1 – Wallboard spray texture: two (2) coats flat latex wall paint

b. Type 2 - Wallboard stipple finish: One (1) coat wall primer/sealer and one (1) coat enamel flat stipple.

c. Type 3 – Natural finish wood casework (doors or trim): One (1) coat lacquer sanding sealer with color and one (1) coat lacquer semi-gloss.

d. Type 4 – Interior painted masonry/concrete: Two (2) coats wallpaint flat latex.

e. Type 5 – Interior stain wood: Two (2) coats Cabot transparent

f. Type 6 – Interior metal: One (1) coat enamel synthetic semi-gloss over one (1) coat primer.

SECTION 9B - DRYWALL

9B.01 SCOPE OF THE WORK

Furnish and install all gypsum drywall, taping and all related work complete as shown.

9B.02 MATERIALS

5/8" Gypsum Board as manufactured by US Gypsum Co., National Gypsum Co., or equal.

5/8" board shall be fire code type "x"

taping shall be Perf-a-tape System using Perf-a-trim components.

9B.03 WORKMANSHIP

Workmanship shall be without blemish.

Where texturing or stippling is omitted, install SW edge boards vertically. Texturing is specified in Section 9A.

SECTION 9C - RESILIENT FLOOR COVERING

9C.01 SCOPE OF THE WORK

Furnish and install all composition floor covering where shown on the drawings. Provide 20 whole tile extra (each color) to Owner and one piece of 6'x9' sheet vinyl (each color) as extra material.

9C.02 MATERIAL

Vinyl sheets or tile – 1/8" thick vinyl Armstrong "Excelon" or approved equal. Adhesive as recommended by manufacturer, colors as selected with 4" high rubber base of solid color (Burke or equal). Install over 5/16" underlayment.

9C.03 WORKMANSHIP

The Contractor shall be responsible for all failures and defects in his work. Any floor surfaces which are unsatisfactory shall be brought to the attention of the Owner before proceeding.

DIVISION 9D

SECTION 9E - ACOUSTICAL CEILINGS

9E.01 SCOPE OF THE WORK

Furnish and install all suspended acoustical ceilings shown on the drawings. Provide 20 whole panels (each color) to Owner as extra material.

9E.02 MATERIALS

Armstrong acoustical panels shall be 5/8" thick, 2'x4' and 2'x2' as shown on the drawings. T bar system shall be standard white aluminum or steel, Donn or equal, one hour rated, with required hold-down clips. Tile shall be Armstrong "Minaboard" mineral fiber panels with fissured design, size x 5/8", flame spread class 25, Federal Specifications No.SS-S-118a, NRC of .50-.60, light reflectance of 75% minimum or approved equal.

9E.03 INSTALLATION

Installation shall be true and level without "kinking" of wires and in accordance with manufacturer's written instructions. Suspension shall be by

minimum 10 gauge wires at 4'-0" on center each way. Provide extra wires at all light fixture corners. Employ "trapeze" type hangers at large ducts, etc. No "swing" type hangers will be permitted. (see details)

SECTION 9F - VINYL WALL COVERING

9F.01 SCOPE OF THE WORK

Public waiting rooms and corridors to be vinyl covered. Contractor shall furnish and install BFGoodrich Koroseal Type II, total weight not less than 24 ounce. Ply, vinyl weight not less than 20.7 ounce. Ply, or equal. Color and pattern shall be selected by Owner. Submit examples, fawn, beige, desert tan. Provide an extra ½ roll, 54" wide.

SECTION 9G - TILE FLOORING

9G.01 SCOPE OF THE WORK

Furnish and install ceramic tile on floors and walls, thin set method per Tile Council of America. See drawing for sizes and TCA specifications. Provide 20 whole tiles to the Owner as extra material.

SECTION 10 - SPECIALTIES

SECTION 10A - TOILET ROOM ACCESSORIES

10A.01 SCOPE OF THE WORK

Furnish and install all accessories as noted on drawing schedule. Provide 4 bundles of tissue for all paper dispensing units.

SECTION 10B - TOILET PARTITIONS

10B.01 SCOPE OF THE WORK

The extent of the metal toilet partition work is shown on the drawings.

10B.02 MATERIALS

Metal toilet partitions shall be the following: Floor mounted, overhead-braces partitions with baked enamel finish and outswinging doors. Colors to be selected from standard pallate.

Manufacturers offering products to comply with the requirements for metal toilet partitions include the following (with coat hook and purse shelf):

1. Sanymetal
2. American Sanitary Partition Corp.
3. Global Steel Products Corp.
4. The Mills Company
5. Bobrick Floor Anchored 1031 series

SECTION 10C - FIRE EXTINGUISHERS

10C.01 SCOPE OF THE WORK

Furnish and install 2A-10BC extinguishers in Sultz-Dewey semi-recessed factory finish white cabinets – quantity shown on drawings. (per the Fire Marshal)

DIVISIONS 11, 12 AND 13

Floor Grills: At all building entrances use model KD98 – 1 1/8" stainless steel grating by Kadee Industries (440-439-8650) or approved equal.

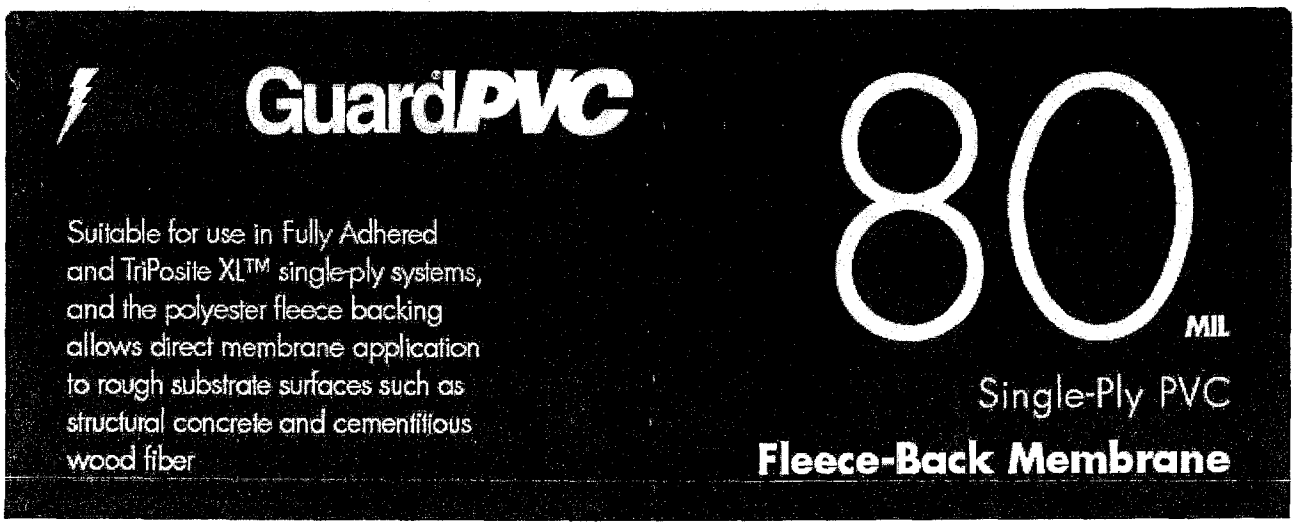
DIVISION 15 AND 16 - MECHANICAL AND ELECTRICAL

Separately bound and submitted mechanical and electrical specifications.

HINDU COMMUNITY AND CULTURAL CENTER

Building D

Roofing



EverGuard® PVC 80 mil Fleece-Back Single-Ply PVC Roofing Membrane

GAF EverGuard® PVC 80 mil Fleece-Back (FB) thermoplastic PVC copolymer single-ply membrane systems have been engineered to provide superior long-term performance and enhanced durability. Strong, flexible EverGuard® PVC 80 mil FB membrane is suitable for use in Fully Adhered and TriPosite XL™ single-ply systems.

Compared to other heavy-duty single-ply EPDM, PVC and TPO membranes, GAF EverGuard® PVC 80 mil FB roofing membrane provides the benefits of all three materials in a single membrane: low installed cost, heat welded seams, white reflective color, no liquid plasticizers and tear/puncture resistance.

Applicable Standards

UL Listed, FM Approved, Dade County Product Approval, Florida Building Code Approved, Title 24 Compliant, ENERGY STAR® Listed, ASTM D-4434, Type III.

Physical Properties	ASTM Test Method	ASTM D-4434 Standard Minimum	EverGuard® Typical Test Data
1. Certain data is provided in MD (machine direction) x CMD (cross machine direction) format. 2. Data is based upon typical product performance, and is subject to normal manufacturing tolerance and variance			
Nominal Thickness	ASTM D-751	0.045"	0.080"
Breaking Strength	ASTM D-751 Grab Method	200 lbf/in.	319 lbf x 462 lbf
Seam Strength	ASTM D-751	75% of Breaking Strength	>95% (membrane failure)
Elongation at Break	ASTM D-751	15%	40% x 40%
Heat Aging	ASTM D-3045	90% Retention of Breaking Strength at Elongation and Breaking	>95% (no significant change)
Tear Strength	ASTM D-751 8" x 8" Sample	45 lbf	66 lbf x 112 lbf
Low Temperature Bend	ASTM D-2136	-40 F	-40 F
Permeance	ASTM E-96	Not Established	0.01 Perms

Documents

Application Instructions

- EverGuard® TPO/PVC Application & Specification Manual (with CAD Details) 05/05/2011 *(PDF)*
- EverGuard® TPO/PVC Application & Specification Manual (without CAD Details) 04/05/2011 *(PDF)*

Brochures & Data Sheets

- Commercial Full Line Brochure 03/31/2011 *(PDF)*
- EverGuard® PVC 80 mil Fleece-Back Membrane - Product Data Sheet 08/04/2010 *(PDF)*
- EverGuard® PVC Brochure 07/06/2011 *(PDF)*
- GAF Perimeter Edge Metal Brochure 12/31/9999 *(PDF)*

Warranty Information

- EverGuard® Diamond Pledge NDL Roof Guarantee - Warranty 09/12/2011 *(PDF)*
- EverGuard® System Pledge Roof Guarantee - Warranty 06/01/2008 *(PDF)*

Codes - Florida Building Code Reports

- EverGuard® EGFB Single Ply Roof Membrane Systems - Florida Approval FL3443-R2 06/01/2009 *(PDF)*

Material Safety Data Sheet (MSDS)

- EverGuard® PVC (1) - MSDS #1094 12/01/2008 *(PDF)*
- EverGuard® PVC (2) - MSDS #2000 05/01/2008 *(PDF)*

Dimensional Change	ASTM D-1204 @212 F, 1 hr.	0.5% (max.)	0.10%
Water Absorption	ASTM D-750 @158 F, 1 week	+/-3% (max.)	0.60%
Accelerated Weathering	ASTM G-53 UV-B, 8 hr. @70 C condensate, 4 hr. @50 C 5,000 hrs. exposure	No visible deterioration @ 7 x magnification	No visible deterioration @ 7 x magnification
Reflectivity (white)	ASTM C1549	N/A	0.85
Emissivity (white)	ASTM C1371	N/A	0.86

CSI Formatted Specifications

AutoCAD Construction Details

Roll Size

Colors	Full Roll Size	Full Roll Weight	Half Roll Size	Half Roll Weight
White, Gray & Tan	76" x 60' (380 sq.ft.)	225 lbs.	N/A	N/A
Note: Membrane rolls shipped horizontally on pallets, stacked pyramid-style and banded.				

Storage

Store rolls on their sides on pallets or shelving in a dry area.

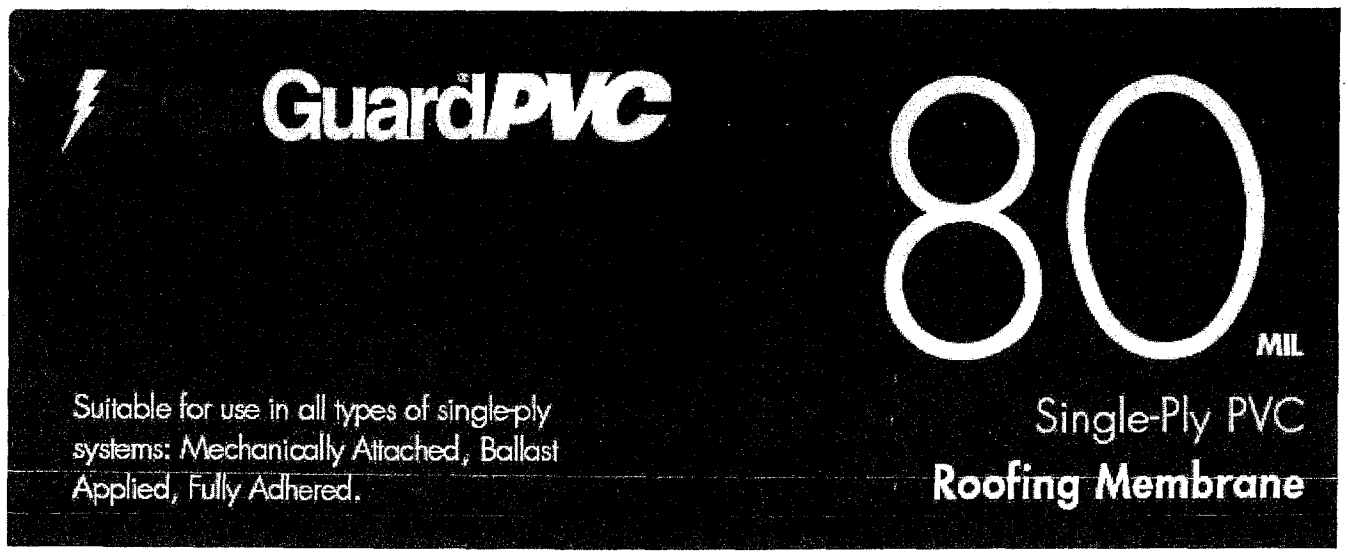
Safety Warning

Membrane rolls are heavy. Position and install by at least two people.

Note: Product sizes, dimensions, and widths are nominal values and are subject to normal manufacturing/packaging tolerance and variation

* White Membrane Only

- PROVIDE WHITE COLORED MEMBRANE
- IF FLEECE-BACKED MEMBRANE CAN BE INSTALLED BY MECHANICALLY FASTENED METHOD PROVIDE 80 MIL THICK FLEECE-BACKED EVERGUARD PVC MEMBRANE. IF NOT, THEN PROVIDE, EVER GUARD PVC 80 mil, SINGLE-PLY PVC ROOFING MEMBRANE THAT CAN BE MECHANICALLY ATTACHED SEE ATTACHED



EverGuard® PVC 80 mil

Single-Ply PVC Roofing Membrane

GAF EverGuard® PVC 80 mil thermoplastic single-ply membrane systems have been engineered to provide superior long-term performance and enhanced durability. Strong, flexible EverGuard® PVC 80 mil membrane is suitable for use in all types of single-ply systems: Mechanically Attached, Ballast Applied, Fully Adhered.

Compared to other heavy-duty single-ply EPDM, PVC and TPO membranes, GAF EverGuard® 80 mil roofing membrane provides the benefits of all three materials in a single membrane: low installed cost, heat welded seams, white reflective color, and tear/puncture resistance.

Applicable Standards

UL Listed, FM Approved, CRRC Listed, Title 24 Compliant, ENERGY STAR® Listed, ASTM D4434, Type III

Physical Properties	ASTM Test Method	ASTM D-4434 Standard Minimum	EverGuard® Typical Test Data
1. Certain data is provided in MD (machine direction) x CMD (cross machine direction) format. 2. Data is based upon typical product performance, and is subject to normal manufacturing tolerance and variance			
Nominal Thickness	ASTM D-751	0.045"	0.080"
Breaking Strength	ASTM D-751 Grab Method	200 lbf/in.	350 lbf x 320 lbf
Seam Strength	ASTM D-751	75% of Breaking Strength	>95% (membrane failure)
Elongation at Break	ASTM D-751	15%	35% x 35%
Heat Aging	ASTM D-3045	90% Retention of Breaking Strength at Elongation and Breaking	>90% (no significant change)
Tear Strength	ASTM D-751 8" x 8" Sample	45 lbf	70 lbf x 80 lbf

Documents

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Codes - Florida Building Code Reports

- EverGuard® PVC Single Ply Roof Membrane Systems - Florida Approval FL3443-R2 06/01/2009 *(PDF)*

Low Temperature Bend	ASTM D-2136	-40 F	-40 F
Permeance	ASTM E-96	Not Established	0.003 Perms
Dimensional Change	ASTM D-1204 @212 F, 1 hr.	0.5% (max.)	0.4%
Water Absorption	ASTM D-750 @158 F, 1 week	+/-3% (max.)	0.06%
Accelerated Weathering	ASTM G-53 UV-B, 8 hr. @70 C condensate, 4 hr. @50 C 5,000 hrs. exposure	No visible deterioration @ 7 x magnification	No visible deterioration @ 7 x magnification
Reflectivity (white)	ASTM C1549	N/A	0.87
Emissivity (white)	ASTM C1371	N/A	0.95

Roll Size

Colors	Full Roll Size	Full Roll Weight	Half Roll Size	Half Roll Weight
White, Gray & Tan	81" x 65' (438 sq.ft.)	234 lbs.	40.5" x 65' (219 sq.ft.)	118 lbs.
Note: Membrane rolls shipped horizontally on pallets, stacked pyramid-style and banded.				

Storage

Store rolls on their sides on pallets or shelving in a dry area.

Safety Warning

Membrane rolls are heavy. Position and install by at least two people.

Note: Product sizes, dimensions, and widths are nominal values and are subject to normal manufacturing/packaging tolerance and variation

* White Membrane Only

Codes - Miami Dade NOAs

- EverGuard® PVC Single Ply Roofing Systems Over Steel Decks - Miami-Dade Approval 10-0113.05 06/30/2010 *(PDF)*

Material Safety Data Sheet (MSDS

- EverGuard® PVC (1) - MSDS #1094 12/01/2008 *(PDF)*
- EverGuard® PVC (2) - MSDS #2000 05/01/2008 *(PDF)*

CSI Formatted Specifications

AutoCAD Construction Details

Permit Application

David Meyers
1751 Peters Ranch Rd
Danville, CA 94525

- 48 Canadian Solar 235 Watt PV Modules to be mounted in 2 separate arrays both portrait orientations with 3 rows of 8 each.

- Each array will be configured with 2 separate PV series source circuits of 12 modules.

    - Module Voltage Open Circuit=36.9V
    - ASHRAE 2% mean dry bulb low temp=-3C
    - Standard Test Conditions 25C
    - Delta T is 28C
    - Temperature correction factor -0.34%/C
    - 28*.34=9.52%
    - 36.9*1.0952=40.41Voc at low temp
    - 40.41Voc*12 in series=**485Voc**
    - 485V<600V

- Each array will be done with a ProSolar GroundTrac Racking system according to ProSolar engineered plans submitted with this application and found at http://prosolar.com/PDFS/INSTALLpdf/GROUNDTRAC.pdf

- Lateral footing span will be 10' max for non-snow loading conditions.

- Label on main electrical panel cover will read:

    Warning
    Multiple Power Sources
    A Photovoltaic System is Present
    240 Vac may be produced.
    DC power circuits
    Disconnect all power sources
    Before servicing
    Test all voltages

- Calculations:
    - Rated MPP Current=7.90A*2=15.80A
    - Rated MPP Voltage=36.9V*12=442.8V
    - Max System Voltage=485V (see calc on previous page)
    - Max Circuit Current=8.46A*2*1.25=21.15A

- Label on DC Disconnect:

PHOTOVOLTAIC POWER SOURCE		
RATED MPP CURRENT	17.80	A
RATED MPP VOLTAGE	442.8	V
MAX SYSTEM VOLTAGE	485	V
MAX CIRCUIT CURRENT	21.15A	A
WARNING: ELECTRICAL SHOCK HAZARD–LINE AND LOAD MAY BE ENERGIZED IN OPEN POSITION		

- 8AWG Grounding Electrode Conductor/Equipment Grounding Conductor will be ran from Inverters to house grounding system.
- Auxiliary ground rod will be driven 8' into ground at array inverters.
- Inverters should be mounted in the shade under soar array
- Inverters come with DC disconnects and Combiners

HINDU COMMUNITY AND CULTURAL CENTER Building D

Title 24

BUILDING ENERGY ANALYSIS REPORT

PROJECT:

HCC Bldg. D
1232 Arrowhead Ave.
Livermore, CA. 94551

Project Designer:

B.R.Govinda Rao S.E.
864 Bandol Way
San Ramon, CA 94382
925-833-9784

Report Prepared by:

Mangalore Suresh
Title 24 Online
531 Natalino Circle
Sacramento, CA 95835
510-793-2658

Job Number:

Bld. D

Date:

10/27/2011

TABLE OF CONTENTS

PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 1 of 3) PERF-1C

Project Name	Climate Zone	Total Cond. Floor Area	Addition Floor Area	Date
HCC Bldg. D				*10/27/2011*
Project Address: *1232 Arrowhead Ave. Livermore*	*CA Climate Zone 12*	*7,087*	*n/a*	

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room
	☐ Relocatable - indicate	☐ specific climate zone	☐ all climates
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration

STATEMENT OF COMPLIANCE

This certificate of compliance lists the building features and specifications needed to comply with Title 24, Parts 1 and 6 of the California Code of Regulations. This certificate applies only to a Building using the performance compliance approach.

The documentation author hereby certifies that the documentation is accurate and complete.

Documentation Author

Name	*Mangalore Suresh*	Signature	
Company	*Title 24 Online*	Date	*10/27/2011*
Address	*531 Natalino Circle*	Phone	*510-793-2658*
City/State/Zip	*Sacramento, CA 95835*		

The Principal Designer hereby certifies that the proposed building design represented in this set of construction documents is consistent with the other compliance forms and worksheets, with the specifications, and with any other calculations submitted with this permit application. The proposed building has been designed to meet the energy efficiency requirements contained in sections 110, 116 through 118, and 140 through 149 of Title 24, Part 6. Please check one:

ENV.	LTG.	MECH.	
☐	☐	☐	I hereby affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code to sign this document as the person responsible for its preparation; and that I am licensed in the State of California as a civil engineer, mechanical engineer, electrical engineer, or I am a licensed architect.
☐	☐	☐	I affirm that I am eligible under the provisions of Division 3 of the Business and Professions Code by section 5537.2 or 6737.3 to sign this document as the person responsible for its preparation; and that I am a licensed contractor performing this work.
☐	☐	☐	I affirm that I am eligible under Division 3 of the Business and Professions Code to sign this document because it pertains to a structure or type of work described as exempt pursuant to Business and Professions Code Sections 5537, 5538 and 6737.1.

Principal Envelope Designer

Name	*B.R.Govinda Rao S.E.*	Signature	
Company	*B.R.Govinda Rao S.E.*	Date	
Address	*864 Bandol Way*	License #	
City/State/Zip	*San Ramon, CA 94382*	Phone	*925-833-9784*

Principal Mechanical Designer

Name	*Kuppe Srinivas P.E.*	Signature	
Company	*Ajmani & Pamidi Inc.*	Date	
Address	*101 California Street Suite 2025*	License #	
City/State/Zip	*San Francisco, CA. 94111*	Phone	*415-305-9344*

Principal Lighting Designer

Name	*Satish Pamidi P.E.*	Signature	
Company	*Ajmani & Pamidi Inc.*	Date	
Address	*101 California Street Suite 2025*	License #	
City/State/Zip	*San Francisco, CA. 94111*	Phone	*415-305-9344*

INSTRUCTIONS TO APPLICANT COMPLIANCE & WORKSHEETS (check box if worksheets are included)

☑	ENV-1C	Certificate of Compliance. Required on plans.	☑	MECH-1C	Certificate of Compliance. Required on plans.
☑	LTG-1C	Certificate of Compliance. Required on plans.	☑	MECH-2C	Air/Water Side/Service Hot Water & Pool Requirements.
☑	LTG-2C	Lighting Controls Credit Worksheet.	☑	MECH-3C	Mechanical Ventilation and Reheat.
☐	LTG-3C	Indoor Lighting Power Allowance.	☑	MECH-5C	Mechanical Equipment Details.

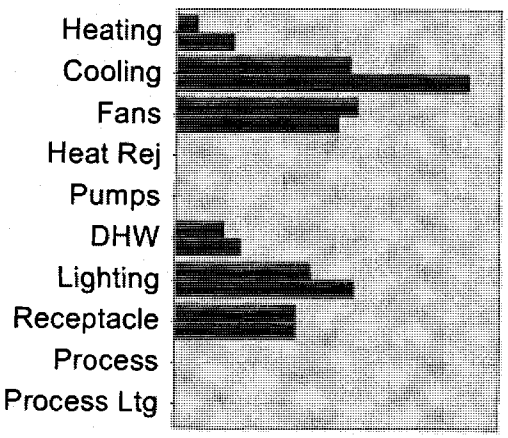
PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 2 of 3) PERF-1C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

ANNUAL TDV ENERGY USE SUMMARY (kBtu/sqft-yr)

Energy Component	Standard Design	Proposed Design	Compliance Margin
Space Heating	20.91	7.33	13.58
Space Cooling	108.22	64.00	44.22
Indoor Fans	60.04	66.88	-6.85
Heat Rejection	0.00	0.00	0.00
Pumps & Misc.	0.00	0.00	0.00
Domestic Hot Water	24.28	17.70	6.58
Lighting	65.96	49.95	16.01
Receptacle	44.44	44.44	0.00
Process	0.00	0.00	0.00
Process Lighting	0.00	0.00	0.00
TOTALS	323.85	250.31	73.54
Percent better than Standard		22.7 %	(22.7 % excluding process)



BUILDING COMPLIES

GENERAL INFORMATION

Building Orientation	(E) 90 deg	Conditioned Floor Area	7,087	sqft.
Number of Stories	1	Unconditioned Floor Area	0	sqft.
Number of Systems	9	Conditioned Footprint Area	6,739	sqft.
Number of Zones	15	Natural Gas Available On Site	Yes	

	Orientation	Gross Area		Glazing Area		Glazing Ratio
Front Elevation	(E)	630	sqft.	150	sqft.	23.8 %
Left Elevation	(S)	1,169	sqft.	192	sqft.	16.4 %
Rear Elevation	(W)	626	sqft.	168	sqft.	26.8 %
Right Elevation	(N)	3,325	sqft.	144	sqft.	4.3 %
Total		5,750	sqft.	654	sqft.	11.4 %
Roof		8,002	sqft.	20	sqft.	0.2 %

	Standard		Proposed		
Prescriptive Lighting Power Density	1.054	W/sqft.	0.799	W/sqft.	Prescriptive Values for Comparison only. See LTG-1C for allowed LPD.
Prescriptive Envelope TDV Energy	198,510		146,329		

Remarks:

PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 3 of 3) PERF-1C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

ZONE INFORMATION

System Name	Zone Name	Occupancy Type	Floor Area (sqft.)	Inst. LPD (W/sf)[1]	Ctrl. Credits (W/sf)[2]	Allowed LPD Area (W/sf)[3]	Allowed LPD Tailored (W/sf)[4]	Proc. Loads (W/sf)
AC-D-4	Zone -4	Classroom, Lecture, Training	714	0.756				
	Zone- 4A	Corridor/Restroom/Support	440	0.341	0.085			
CU/ACC-D-2	Zone-7	Lounge, Recreation	213	0.845				
AC-D-5	Zone-5	Classroom, Lecture, Training	714	0.756				
	Zone- 5A	Corridor/Restroom/Support	242	0.744	0.130			
	Zone -5B	Corridor/Restroom/Support	314	1.433				
AC-D-2	Zone-2	Convention/Conference/Mee	1,077	0.836				
	Zone -2A	Corridor/Restroom/Support	314	1.433				
	Zone- 2B	Corridor/Restroom/Support	586	0.512	0.105			
AC-D-1	Zone-1	Classroom, Lecture, Training	1,034	0.870				
	Zone-1A	Electrical, Mechanical Room	40	1.500				
AC-D-3	Zone -3	Classroom, Lecture, Training	714	0.756				
CU/ACC-D-1	Zone 6	Lounge, Recreation	236	0.890				
CU/ACC-D-3	Zone 8	Lounge, Recreation	213	0.845				
CU/ACC-D-4	Zone 9	Lounge, Recreation	236	0.890				

Notes: 1. See LTG-1C (items marked with asterisk, see LTG-1-C by others) 2. See LTG-2C 3. See LTG-3C (by others) 4. See LTG-4C

Items above require special documentation

EXCEPTIONAL CONDITIONS COMPLIANCE CHECKLIST

The local enforcement agency should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification to be used with the performance approach. The local enforcement agency determines the adequacy of the justifications, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

The HVAC System AC-D-4 includes Demand Control Ventilation per Standards Section 121.

The Zone Zone -4 has a North/East/South Display Perimeter Credit of 52 ft.

The HVAC System CU/ACC-D-2 includes Demand Control Ventilation per Standards Section 121.

The Zone Zone-7 has a North/East/South Display Perimeter Credit of 52 ft.

The HVAC System AC-D-5 includes Demand Control Ventilation per Standards Section 121.

The Zone Zone-5 has a North/East/South Display Perimeter Credit of 40 ft.

The HVAC System AC-D-2 includes Demand Control Ventilation per Standards Section 121.

The HVAC System AC-D-1 includes Demand Control Ventilation per Standards Section 121.

The Zone Zone-1 has a North/East/South Display Perimeter Credit of 40 ft.

The Zone Zone-1A has a North/East/South Display Perimeter Credit of 40 ft.

The HVAC System AC-D-3 includes Demand Control Ventilation per Standards Section 121.

The Zone Zone -3 has a North/East/South Display Perimeter Credit of 52 ft.

The HVAC System CU/ACC-D-1 includes Demand Control Ventilation per Standards Section 121.

The exceptional features listed in this performance approach application have specifically been reviewed. Adequate written justification and documentation for their use have been provided by the applicant.

Authorized Signature or Stamp _____

PERFORMANCE CERTIFICATE OF COMPLIANCE (Part 3 of 3) PERF-1C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

ZONE INFORMATION

System Name	Zone Name	Occupancy Type	Floor Area (sqft.)	Inst. LPD (W/sf)[1]	Ctrl. Credits (W/sf)[2]	Allowed LPD		Proc. Loads (W/sf)
						Area (W/sf)[3]	Tailored (W/sf)[4]	

Notes: 1. See LTG-1C (items marked with asterisk, see LTG-1-C by others) 2. See LTG-2C 3. See LTG-3C (by others) 4. See LTG-4C

Items above require special documentation

EXCEPTIONAL CONDITIONS COMPLIANCE CHECKLIST

The local enforcement agency should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification to be used with the performance approach. The local enforcement agency determines the adequacy of the justifications, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

The HVAC System CU/ACC-D-3 includes Demand Control Ventilation per Standards Section 121.

The HVAC System CU/ACC-D-4 includes Demand Control Ventilation per Standards Section 121.

The HVAC System Trane YHC-072 includes an Economizer. This system has a cooling output < 75,000 Btuh or a supply cfm < 2500.

The Roof R-38 Roof Attic Reflectance = 0.30, Emittance = 0.75 shall be rated and labeled by the Cool Roof Rating Council in accordance with Section 10-1

The exceptional features listed in this performance approach application have specifically been reviewed. Adequate written justification and documentation for their use have been provided by the applicant.

Authorized Signature or Stamp _____

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION								
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
1	*Wall*	*217*	*(N)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
2	*Roof*	*714*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
3	*Slab*	*714*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
4	*Wall*	*26*	*(E)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
5	*Slab*	*440*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
6	*Roof*	*440*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
7	*Wall*	*96*	*(W)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
8	*Roof*	*213*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
1	*Window*	*96*	*(N)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☐	*New*	☐	☐
2	*Window*	*150*	*(E)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☐	*New*	☐	☐
3	*Window*	*48*	*(W)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
4	*Window*	*24*	*(N)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
5	*Window*	*24*	*(N)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
6	*Window*	*24*	*(W)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☐	*New*	☐	☐
7	*Window*	*48*	*(S)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
8	*Window*	*48*	*(S)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION								
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
9	*Slab*	*213*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
10	*Wall*	*217*	*(N)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
11	*Roof*	*714*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
12	*Slab*	*714*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
13	*Slab*	*150*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
14	*Roof*	*150*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
15	*Wall*	*30*	*(W)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
16	*Slab*	*56*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
9	*Skylight*	*20*	*(N)*	*0.490*	*NFRC*	*0.330*	*NFRC*	☐	*New*	☐	☐
10	*Window*	*72*	*(S)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☐	*New*	☐	☐
11	*Window*	*24*	*(W)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
12	*Window*	*48*	*(W)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
13	*Window*	*24*	*(S)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
14	*Window*	*24*	*(W)*	*0.330*	*NFRC*	*0.190*	*NFRC*	☑	*New*	☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION								
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
17	*Roof*	*56*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
18	*Slab*	*36*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
19	*Roof*	*36*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
20	*Wall*	*140*	*(N)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
21	*Slab*	*140*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
22	*Roof*	*140*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
23	*Wall*	*294*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
24	*Roof*	*1,077*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

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HCC Bldg. D	*10/27/2011*

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☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION									
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
25	*Slab*	*1,077*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
26	*Wall*	*140*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
27	*Slab*	*140*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
28	*Roof*	*140*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
29	*Slab*	*520*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
30	*Roof*	*500*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
31	*Wall*	*30*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
32	*Slab*	*36*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION								
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
33	*Roof*	*36*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
34	*Slab*	*30*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
35	*Roof*	*30*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
36	*Wall*	*257*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
37	*Wall*	*172*	*(E)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
38	*Roof*	*1,034*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
39	*Slab*	*1,034*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
40	*Wall*	*80*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION								
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
41	*Wall*	*50*	*(E)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
42	*Roof*	*40*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
43	*Slab*	*40*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
44	*Wall*	*2,607*	*(N)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
45	*Roof*	*714*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
46	*Slab*	*714*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
47	*Wall*	*232*	*(E)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
48	*Wall*	*120*	*(W)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS

					INSULATION									
Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
49	*Roof*	*236*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
50	*Slab*	*236*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
51	*Wall*	*96*	*(W)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
52	*Roof*	*1,476*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
53	*Slab*	*213*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
54	*Wall*	*176*	*(S)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
55	*Roof*	*236*	*(N)*	*0.025*	*R-38*					*4.2.1-A21*	*New*	☐	☐
56	*Slab*	*236*	*(N)*	*0.730*	*None*					*4.4.7-A1*	*New*	☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Project Address	Climate Zone	Total Cond. Floor Area	Addition Floor Area
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type: ☑ Nonresidential ☐ High-Rise Residential ☐ Hotel/Motel Guest Room

☐ Schools (Public School) ☐ Relocatable Public School Bldg. ☑ Conditioned Spaces ☐ Unconditioned Spaces

☐ Skylight Area for Large Enclosed Space ≥ 8000 ft^2 (If checked include the ENV-4C with submittal)

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Approach of Compliance: ☐ Component ☑ Overall Envelope ☐ Unconditioned (file affidavit)

Front Orientation: N, E, S, W or in Degrees: *90 deg*

FIELD INSPECTION ENERGY CHECKLIST

OPAQUE SURFACE DETAILS — **INSULATION**

Tag/ID	Assembly Type	Area (ft^2)	Orientation N, E, S, W	U-Factor	Cavity R-Value	Exterior R-Value	Exterior Furring[3]	Interior R-Value	Interior Furring[3]	Joint Appendix 4	Condition Status	Pass	Fail[2]
57	*Wall*	*116*	*(W)*	*0.069*	*R-21*					*4.3.1-A6*	*New*	☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐
												☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail, then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. A fail does not meet compliance.

FENESTRATION SURFACE DETAILS

Tag/ID	Fenestration Type	Area (ft^2)	Orientation N, E, S, W	Max U-Factor	U-Factor Source	Max (R)SHGC	SHGC Source	Overhang	Conditions Status	Pass	Fail[2]
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐
								☐		☐	☐

1. See Instructions in the Nonresidential Compliance Manual, page 3-96.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 2 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

ROOFING PRODUCT (COOL ROOFS)

(Note if the roofing product is not CRRC certified, this compliance approach cannot be used). Go to Overall Envelope Approach or Performance Approach.

CHECK APPLICABLE BOX BELOW IF EXEMPT FROM THE ROOFING PRODUCT "COOL ROOF" REQUIREMENTS:	Pass	Fail[1]	N/A
☐ Roofing compliance not required in Climate Zones 1 and16 with a Low-Sloped. 2:12 pitch or less.	☐	☐	☐
☐ Roofing compliance not required in Climate Zone 1 with a Steep-Sloped with less than 5 lb/ft^2. Greater than 2:12 pitch.	☐	☐	☐
☐ Low-sloped Wood framed roofs in Climate Zones 3 and 5 are exempted, solar reflectance and thermal emittance or SRI that have a U-factor of 0.039 or lower. See Opaque Surface Details roof assembly, Column H of ENV-2C.	☐	☐	☐
☐ Low-sloped Metal building roofs in Climate Zone 3 and 5 are exempted, solar relectance and thermal emittance or SRI that have a U-factor of 0.048 or lower. See Opaque Surface Details roof assembly below, Column H of ENV-2C.	☐	☐	☐
☐ The roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are exempted. Solar reflectance and thermal emittance or SRI, see spreadsheet calculator at www.energy.ca.gov/title24/	☐	☐	☐
☐ Roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft^2 are exempt from the Cool Roof criteria below.	☐	☐	☐
☐ High-rise residential buildings and hotels and motels with low-sloped roofs in Climate Zones 1 through 9, 12 and 16 are exempted from the low-sloped roofing criteria.	☐	☐	☐

1. If Fail then describe on this page of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

CRRC Product ID Number[1]	Roof Slope ≤ 2:12	Roof Slope > 2:12	Product Weight < 5lb/ft^2	Product Weight ≥ 5lb/ft^2	Product Type[2]	Aged Solar Reflectance[3]		Thermal Emmitance	SRI[5]	Pass	Fail[6]
R-38 Roof Attic	☑	☐	☑	☐		☐ [4]	*0.30*	*0.75*		☐	☐
	☐	☐	☐	☐		☐ [4]				☐	☐
	☐	☐	☐	☐		☐ [4]				☐	☐
	☐	☐	☐	☐		☐ [4]				☐	☐
	☐	☐	☐	☐		☐ [4]				☐	☐
	☐	☐	☐	☐		☐ [4]				☐	☐

1. The CRRC Product ID Number can be obtained from the Cool Roof Rating Council's Rated Product Directory at www.coolroofs.org/products/search.php
2. Indicate the type of product is being used for the roof top, i.e. single-ply roof, asphalt roof, metal roof, etc.
3. If the Aged Reflectance is not available in the Cool Roof Rating Council's Rated Product Directory then use the Initial Reflectance value from the same directory and use the equation $(0.2+0.7(\rho_{initial} - 0.2)$ to obtain a calculated aged value. Where ρ is the Initial Solar Reflectance from the Cool Roof Rating Council's Rated Product Directory.
4. Check box if the Aged Reflectance is a calculated value using the equation above.
5. The SRI value needs to be calculated from a spreadsheet calculator at http://www.energy.ca.gov/title24/
6. If Fail then describe on this page of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

To apply **Liquid Field Applied Coatings**, the coating must be applied across the entire roof surface and meet the dry mil thickness or coverage recommended by the coatings manufacturer and meet minimum performance requirements listed in §118(i)4. Select the applicable coating:

☐ Aluminum-Pigmented Asphalt Roof Coating ☐ Cement-Based Roof Coating ☐ Other _____

Discrepancies:

CERTIFICATE OF COMPLIANCE AND FIELD INSPECTION ENERGY CHECKLIST

(Part 3 of 3) **ENV-1C**

Project Name	Date
HCC Bldg. D	*10/27/2011*

Required Acceptance Tests

Designer:

This form is to be used by the designer and attached to the plans. Listed below is the acceptance test for Envelope Fenestrations system. The designer is required to check the acceptance tests and list all the fenestration products that require an acceptance test. If all the site-built fenestration of a certain type requires a test, list the different fenestration products and the number of systems. The NA7 Section in the Appendix of the Nonresidential Reference Appendices Manual describes the test. Since this form will be part of the plans, completion of this section will allow the responsible party to budget for the scope of work appropriately.

Enforcement Agency:

Systems Acceptance. Before Occupancy Permit is granted for a newly constructed building or space or whenever new fenestration is installed in the building or space shall be certified as meeting the Acceptance Requirements.
The ENV-2A form is not considered a complete form and is not to be accepted by the enforcement agency unless the boxes are checked and/or filled and signed. In addition, a Certificate of Acceptance forms shall be submitted to the enforcement agency that certifies plans, specifications, installation certificates, and operating and maintenance information meet the requirements of §10-103(b) of Title 24 Part 6. The field inspector must receive the properly filled out and signed forms before the building can receive final occupancy. A copy of the ENV-2A for each different fenestration product line must be provided to the owner of the building for their records.

Test Description		**ENV-2A**	**Test Performed By:**
Fenestration Products Name or ID Requiring Testing or Verification	Area of like Products	Building Envelope Acceptance Test	
PPG SOLARBAN 80 XL	*654*	☑	
Velux Skylight Lo E	*20*	☑	
		☐	
		☐	
		☐	
		☐	
		☐	
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		☐	

CERTIFICATE OF COMPLIANCE (Part 1 of 3) LTG-1C

Project Name: *HCC Bldg. D*
Date: *10/27/2011*

INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Installation Certificate, LTG-1- INST (Retain a copy and verify form is completed and signed.)	**Field Inspector** ☐
Certificate of Acceptance, LTG-2A and LTG-3A (Retain a copy and verify form is completed and signed.)	**Field Inspector** ☐

A separate Lighting Schedule Must Be Filled Out for Conditioned and Unconditioned Spaces Installed Lighting Power listed on this Lighting Schedule is only for:

☑ **CONDITIONED SPACE** ☐ **UNCONDITIONED SPACE**

☑ The actual indoor lighting power listed below includes all installed permanent and portable lighting systems in accordance with §146(a).

☑ Only for offices: Up to the first 0.2 watts per square foot of portable lighting shall not be required to be included in the calculation of actual indoor lighting power density in accordance with the Exception to §146(a). All portable lighting in excess of 0.2 watts per square foot is totaled below.

	Luminaire (Type, Lamps, Ballasts)	Installed Watts							
A	B	C	D	E		F	G	H	
				How wattage Was determined				Field Inspector[2]	
None or Item Tag	Complete Luminaire Description[1] (i.e, 3 lamp fluorescent troffer, F32T8, one dimmable electronic ballasts)		Watts per Luminaire[1]	CEC Default From NA8	According To §130 (d or e)	Number of Luminaires	Installed Watts (D X F)	Pass	Fail
L1	*2'X4' Recessed Fluorescent Fixture W/F028T5*		*60.0*	☑	☐	*57*	*3,420*	☐	☐
L2	*2'X2' Recessed Fluorescent Fixture W/F014T5*		*30.0*	☑	☐	*15*	*450*	☐	☐
L3	*6" Recessed CFL W/1-26DTT*		*30.0*	☑	☐	*58*	*1,740*	☐	☐
L7	*2-T5 Lamp Fluorescent Strip*		*60.0*	☑	☐	*3*	*180*	☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
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				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
				☐	☐			☐	☐
						Installed Watts Page Total:	*5,790*		

Building total number of pages:		Installed Watts Building Total (Sum of all pages)	*5,790*
		Enter into LTG-1C Page 4 of 4	

1. Wattage shall be determined according to Section 130 (d and e). Wattage shall be rating of light fixture, not rating of bulb.
2. If Fail then describe on Page 2 of the Inspection Checklist Form and take appropriate action to correct. Verify building plans if necessary.

Project Name	Date
HCC Bldg. D	*10/27/2011*

INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Fill in controls for all spaces: a) area controls, b) multi-level controls, c) manual daylighting controls for daylit areas > 250 ft^2, automatic daylighting controls for daylit areas > 2,500 ft^2, d) shut-off controls, e) display lighting controls, f) tailored lighting controls – general lighting controlled separately from display, ornamental and display case lighting and g) demand responsive automatic controls for retail stores > 50,000 ft^2, in accordance with Section 131.

MANDATORY LIGHTING CONTROLS – FIELD INSPECTION ENERGY CHECKLIST

Type/ Description	Number of Units	Location in Building	Special Features	Field Inspector Pass	Field Inspector Fail
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
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SPECIAL FEATURES INSPECTION CHECKLIST (See Page 2 of 4 of LTG-1C)

The local enforcement agency should pay special attention to the items specified in this checklist. These items require special written justification and documentation, and special verification. The local enforcement agency determines the adequacy of the justification, and may reject a building or design that otherwise complies based on the adequacy of the special justification and documentation submitted.

Field Inspector's Notes or Discrepancies:

CERTIFICATE OF COMPLIANCE (Part 3 of 3) LTG-1C

Project Name	Date
HCC Bldg. D	*10/27/2011*

CONDITIONED AND UNCONDITIONED SPACE LIGHTING MUST NOT BE COMBINED FOR COMPLIANCE

Indoor Lighting Power for Conditioned Spaces		Watts	Indoor Lighting Power for Unconditioned Spaces		Watts
Installed Lighting (from Conditioned LTG-1C, Page 2)		*5,790*	**Installed** Lighting (from Unconditioned LTG-1C, Page 2)		*0*
Lighting Control Credit Conditioned Spaces (from LTG-2C)	-	*131*	Lighting Control Credit Unconditioned Spaces (from LTG-2C)	-	*0*
Adjusted **Installed** Lighting Power	=	*5,660*	Adjusted **Installed** Lighting Power	=	*0*
Complies if **Installed** ≤ **Allowed**		↕	Complies if **Installed** ≤ **Allowed**		↕
Allowed Lighting Power Conditioned Spaces (from LTG-3C or PERF-1)		*5,660*	**Allowed** Lighting Power Unconditioned Spaces (from LTG-3C)		*0*

Required Acceptance Tests

Designer:

This form is to be used by the designer and attached to the plans. Listed below is the acceptance test for the Lighting system, **LTG-2A and LTG-3A**. The designer is required to check the acceptance tests and list all control devices serving the building or space shall be certified as meeting the Acceptance Requirements for Code Compliance. If all the lighting system or control of a certain type requires a test, list the different lighting and the number of systems. The NA7 Section in the Appendix of the Nonresidential Reference Appendices Manual describes the test. Since this form will be part of the plans, completion of this section will allow the responsible party to budget for the scope of work appropriately. **Forms can be grouped by type of Luminaire controlled.**

Enforcement Agency:

Systems Acceptance. Before Occupancy Permit is granted for a newly constructed building or space or when ever new lighting system with controls is installed in the building or space shall be certified as meeting the Acceptance Requirements.
The **LTG-2A and LTG-3A** forms are not considered complete forms and are not to be accepted by the enforcement agency unless the boxes are checked and/or filled and signed. In addition, a Certificate of Acceptance forms shall be submitted to the enforcement agency that certifies plans, specifications, installation certificates, and operating and maintenance information meet the requirements of §10-103(b) of Title 24 Part 6. The field inspector must receive the properly filled out and signed forms before the building can receive final occupancy. A copy of the **LTG-2A and LTG-3A** for each different lighting luminaire control(s) must be provided to the owner of the building for their records.

Luminaires Controlled				LTG-2A and LTG-3A
Equipment Requiring Testing	Description	Number of Luminaires controlled	Location	Controls and Sensors and Automatic Daylighting Controls Acceptance
Occ Sensor - Hallway	*2'X2' Recessed Fluorescent Fixture W*	*5*	*Corridor # 2/Vestibule*	☑
Occ Sensor - Hallway	*2'X2' Recessed Fluorescent Fixture W*	*3*	*Corridor # 1*	☑
Occ Sensor - Storage	*2-T5 Lamp Fluorescent Strip*	*1*	*Storage Rm # 113*	☑
Occ Sensor - Hallway	*2'X2' Recessed Fluorescent Fixture W*	*7*	*Corridor # 108*	☑
Occ Sensor - Storage	*2-T5 Lamp Fluorescent Strip*	*1*	*Janitor Rm # 107*	☑
				☐
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CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 1 of 4) MECH-1C

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room	
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)	
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration	
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)	
Front Orientation: N, E, S, W or in Degrees:	*90 deg*			

HVAC SYSTEM DETAILS

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Meets Criteria or Requirements: Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*DHW Heater*	☐	☐
Equipment Type[3]:	*Gas Fired DHW Boiler*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*199,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*0.85 EF*	☐	☐
Max Allowed Cooling Capacity[1]	*n/a*	☐	☐
Cooling Efficiency[1]	*n/a*	☐	☐
Duct Location/ R-Value	*n/a*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*n/a*	☐	☐
Economizer	*n/a*	☐	☐
Thermostat	*n/a*	☐	☐
Fan Control	*n/a*	☐	☐

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AC-D-4*	☐	☐
Equipment Type[3]:	*Packaged DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*48,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*80% AFUE*	☐	☐
Max Allowed Cooling Capacity[1]	*62,400 Btu/hr*	☐	☐
Cooling Efficiency[1]	*12.0 SEER / 12.7 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 4) **MECH-1C**

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room	
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)	
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration	
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)	
Front Orientation: N, E, S, W or in Degrees:	*90 deg*			

HVAC SYSTEM DETAILS

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** Meets Criteria or Requirements: **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*CU/ACC-D-2*	☐	☐
Equipment Type[3]:	*Split DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*16,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*12.00 HSPF*	☐	☐
Max Allowed Cooling Capacity[1]	*12,000 Btu/hr*	☐	☐
Cooling Efficiency[1]	*0.0 SEER / 14.5 EER*	☐	☐
Duct Location/ R-Value	*Attic, Roof Ins / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AC-D-5*	☐	☐
Equipment Type[3]:	*Packaged DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*48,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*80% AFUE*	☐	☐
Max Allowed Cooling Capacity[1]	*62,400 Btu/hr*	☐	☐
Cooling Efficiency[1]	*12.0 SEER / 12.7 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 1 of 4) MECH-1C

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room	
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)	
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration	
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)	
Front Orientation: N, E, S, W or in Degrees:	*90 deg*			

HVAC SYSTEM DETAILS

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** Meets Criteria or Requirements: **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AC-D-2*	☐	☐
Equipment Type[3]:	*Packaged DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*64,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*80% AFUE*	☐	☐
Max Allowed Cooling Capacity[1]	*72,500 Btu/hr*	☐	☐
Cooling Efficiency[1]	*12.7 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*Fixed Temp (Integrated)*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AC-D-1*	☐	☐
Equipment Type[3]:	*Packaged DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*48,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*80% AFUE*	☐	☐
Max Allowed Cooling Capacity[1]	*62,400 Btu/hr*	☐	☐
Cooling Efficiency[1]	*12.0 SEER / 12.7 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST

(Part 1 of 4) **MECH-1C**

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room	
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)	
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration	
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)	
Front Orientation: N, E, S, W or in Degrees:	*90 deg*			

HVAC SYSTEM DETAILS

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** Meets Criteria or Requirements: **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*AC-D-3*	☐	☐
Equipment Type[3]:	*Split DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*48,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*81% AFUE*	☐	☐
Max Allowed Cooling Capacity[1]	*49,450 Btu/hr*	☐	☐
Cooling Efficiency[1]	*12.0 SEER / 12.8 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

Equipment[2]	**Inspection Criteria**	**FIELD INSPECTION ENERGY CHECKLIST** **Pass**	**Fail – Describe Reason**[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*CU/ACC-D-1*	☐	☐
Equipment Type[3]:	*Split DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*16,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*12.00 HSPF*	☐	☐
Max Allowed Cooling Capacity[1]	*12,000 Btu/hr*	☐	☐
Cooling Efficiency[1]	*0.0 SEER / 14.5 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 1 of 4) MECH-1C

Project Name			Date
HCC Bldg. D			*10/27/2011*
Project Address	**Climate Zone**	**Total Cond. Floor Area**	**Addition Floor Area**
1232 Arrowhead Ave. Livermore	*12*	*7,087*	*n/a*

GENERAL INFORMATION

Building Type:	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel Guest Room	
☐ Schools (Public School)	☐ Relocatable Public School Bldg.	☑ Conditioned Spaces	☐ Unconditioned Spaces (affidavit)	
Phase of Construction:	☑ New Construction	☐ Addition	☐ Alteration	
Approach of Compliance:	☐ Component	☐ Overall Envelope TDV Energy	☐ Unconditioned (file affidavit)	
Front Orientation: N, E, S, W or in Degrees:	*90 deg*			

HVAC SYSTEM DETAILS

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Meets Criteria or Requirements: Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*CU/ACC-D-3*	☐	☐
Equipment Type[3]:	*Split DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*16,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*12.00 HSPF*	☐	☐
Max Allowed Cooling Capacity[1]	*12,000 Btu/hr*	☐	☐
Cooling Efficiency[1]	*0.0 SEER / 14.5 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

Equipment[2]	Inspection Criteria	FIELD INSPECTION ENERGY CHECKLIST Pass	Fail – Describe Reason[2]
Item or System Tags (i.e. AC-1, RTU-1, HP-1)	*CU/ACC-D-4*	☐	☐
Equipment Type[3]:	*Split DX*	☐	☐
Number of Systems	*1*	☐	☐
Max Allowed Heating Capacity[1]	*16,000 Btu/hr*	☐	☐
Minimum Heating Efficiency[1]	*12.00 HSPF*	☐	☐
Max Allowed Cooling Capacity[1]	*12,000 Btu/hr*	☐	☐
Cooling Efficiency[1]	*0.0 SEER / 14.5 EER*	☐	☐
Duct Location/ R-Value	*Attic, Ceiling Ins, vented / 8.0*	☐	☐
When duct testing is required, submit **MECH-4A** & **MECH-4-HERS**	*No*	☐	☐
Economizer	*No Economizer*	☐	☐
Thermostat	*Setback Required*	☐	☐
Fan Control	*Constant Volume*	☐	☐

1. If the Actual installed equipment performance efficiency and capacity is less than the Proposed (from the energy compliance submittal or from the building plans) the responsible party shall resubmit energy compliance to include the new changes.
2. For additional detailed discrepancy use Page 2 of the Inspection Checklist Form. Compliance fails if a Fail box is checked.
3. Indicate Equipment Type: Gas (Pkg or, Split), VAV, HP (Pkg or split), Hydronic, PTAC, or other.

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST	(Part 2 of 4)	MECH-1C
Project Name: *HCC Bldg. D*		Date: *10/27/2011*

Discrepancies:

CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 3 of 4) MECH-1C

Project Name	Date
HCC Bldg. D	*10/27/2011*

Required Acceptance Tests

Designer:

This form is to be used by the designer and attached to the plans. Listed below are all the acceptance tests for mechanical systems. The designer is required to check the applicable boxes by all acceptance tests that apply and listed all equipment that requires an acceptance test. If all equipment of a certain type requires a test, list the equipment description and the number of systems. The NA number designates the Section in the Appendix of the Nonresidential Reference Appendices Manual that describes the test. Since this form will be part of the plans, completion of this section will allow the responsible party to budget for the scope of work appropriately.

Building Departments:

Systems Acceptance: Before occupancy permit is granted for a newly constructed building or space, or a new space-conditioning system serving a building or space is operated for normal use, all control devices serving the building or space shall be certified as meeting the Acceptance Requirements for Code Compliance.
Systems Acceptance: Before occupancy permit is granted. All newly installed HVAC equipment must be tested using the Acceptance Requirements.

The MECH-1C form is not considered a completed form and is not to be accepted by the building department unless the correct boxes are checked. The equipment requiring testing, person performing the test (Example: HVAC installer, TAB contractor, controls contractor, PE in charge of project) and what Acceptance test must be conducted. The following checked-off forms are required for **ALL** newly installed equipment. In addition a Certificate of Acceptance forms shall be submitted to the building department that certifies plans, specifications, installation, certificates, and operating and maintenance information meet the requirements of §10-103(b) and Title-24 Part 6. The building inspector must receive the properly filled out and signed forms before the building can receive final occupancy.

TEST DESCRIPTION		MECH-2A	MECH-3A	MECH-4A	MECH-5A	MECH-6A	MECH-7A	MECH-8A	MECH-9A	MECH-10A	MECH-11A
Equipment Requiring Testing or Verification	Qty.	Outdoor Ventilation For VAV & CAV	Constant Volume & Single-Zone Unitary	Air Distribution Ducts	Economizer Controls	Demand Control Ventilation DCV	Supply Fan VAV	Valve Leakage Test	Supply Water Temp. Reset	Hydronic System Variable Flow Control	Automatic Demand Shed Control
Trane YHC-060	*3*	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
12RLS/AOU112RLS	*1*	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Trane YHC-072	*1*	☐	☑	☐	☑	☑	☐	☐	☐	☐	☐
Trane YHC-048	*1*	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
12RLS/AOU112RLS	*3*	☑	☑	☐	☐	☑	☐	☐	☐	☐	☐
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CERTIFICATE OF COMPLIANCE and FIELD INSPECTION ENERGY CHECKLIST (Part 4 of 4) MECH-1C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

TEST DESCRIPTION		MECH-12A	MECH-13A	MECH-14A	MECH-15A	
Equipment Requiring Testing	Qty.	Fault Detection & Diagnostics for DX Units	Automatic Fault Detection & Diagnostics for Air & Zone	Distributed Energy Storage DX AC Systems	Thermal Energy Storage (TES) Systems	Test Performed By:
Trane YHC-060	*3*	☐	☐	☐	☐	
12RLS/AOU112RLS	*1*	☐	☐	☐	☐	
Trane YHC-072	*1*	☐	☐	☐	☐	
Trane YHC-048	*1*	☐	☐	☐	☐	
12RLS/AOU112RLS	*3*	☐	☐	☐	☐	
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LIGHTING CONTROLS CREDIT WORKSHEET (Part 1 of 2) LTG-2C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

POWER ADJUSTMENT FACTORS (PAF) FOR NON-DAYLIGHT CONTROLS

A Separate PAF Worksheet Must Be Filled Out for Conditioned and Unconditioned Spaces. Control Credits listed on this schedule are only for:

☑ **CONDITIONED SPACES** ☐ **UNCONDITIONED SPACES**

A	B	C	D	E	F	G
Room # Zone ID Areas	Lighting Control Description[1]	Plan Reference	Room Area (ft^2)	Watts of Control Lighting	Power Adjustments Factor[2]	Control Credit Watts (E x F)
Corridor # 2/Vestibu	*Occ Sensor - Hallway*	*L2*	*440*	*150*	*0.25*	*38*
Corridor # 1	*Occ Sensor - Hallway*	*L2*	*150*	*90*	*0.25*	*23*
Storage Rm # 113	*Occ Sensor - Storage*	*L7*	*56*	*60*	*0.15*	*9*
Corridor # 108	*Occ Sensor - Hallway*	*L2*	*520*	*210*	*0.25*	*53*
Janitor Rm # 107	*Occ Sensor - Storage*	*L7*	*30*	*60*	*0.15*	*9*

PAGE TOTAL	*131*
Building total of non-daylight control credit watts for all pages of LTG-2C Page 1 of 2	
Enter building total of all daylight controls credit watts from LTG-2C Page 2 of 2	*0*
BUILDING TOTAL OF ALL CONTROL CREDIT WATTS (FOR BOTH NON-DAYLIGHT AND DAYLIGHT CONTROL CREDITS) Enter in LTG-1C; Page 4: Lighting Control Credit as appropriate for CONDITIONED or UNCONDITIONED Spaces	*131*

Note: Conditioned and Unconditioned Space shall be separately totaled

1. Description shall be consistent with Type of Control defined in Table 146-C
2. Power Adjustment Factor taken from Table 146-C

AIR SYSTEM REQUIREMENTS (Part 1 of 2) MECH-2C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

Item or System Tags (i.e. AC-1, RTU-1, HP-1)		AC-D-4	CU/ACC-D-2	AC-D-5
		Indicate Air Systems Type (Central, Single Zone, Package, VAV, or etc...)		
Number of Systems		1	1	1
		Indicate Page Reference on Plans or Schedule and indicate the applicable exception(s)		
MANDATORY MEASURES	**T-24 Sections**			
Heating Equipment Efficiency	112(a)	*80% AFUE*	*12.00 HSPF*	*80% AFUE*
Cooling Equipment Efficiency	112(a)	*12.0 SEER / 12.7 EER*	*0.0 SEER / 14.5 EER*	*12.0 SEER / 12.7 EER*
HVAC Heat Pump Thermostat	112(b), 112(c)	*n/a*	*Yes*	*n/a*
Furnace Controls/Thermostat	112(c), 115(a)	*n/a*	*n/a*	*n/a*
Natural Ventilation	121(b)	*Yes*	*Yes*	*Yes*
Mechanical Ventilation	121(b)	*595 cfm*	*32 cfm*	*695 cfm*
VAV Minimum Position Control	121(c)	*No*	*No*	*No*
Demand Control Ventilation	121(c)	*Yes*	*Yes*	*Yes*
Time Control	122(e)	*Programmable Switch*	*Programmable Switch*	*Programmable Switch*
Setback and Setup Control	122(e)	*Setback Required*	*Setback Required*	*Setback Required*
Outdoor Damper Control	122(f)	*Auto*	*Auto*	*Auto*
Isolation Zones	122(g)	*n/a*	*n/a*	*n/a*
Pipe Insulation	123			
Duct Location/ R-value	124	*Attic, Ceiling Ins, vented / 8.0*	*Attic, Roof Ins / 8.0*	*Attic, Ceiling Ins, vented / 8.0*
PRESCRIPTIVE MEASURES				
Calculated Design Heating Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Heating Capacity	144(a & b)	*48,000 Btu/hr*	*8,919 Btu/hr*	*48,000 Btu/hr*
Calculated Design Cooling Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Cooling Capacity	144(a & b)	*51,148 Btu/hr*	*10,824 Btu/hr*	*40,207 Btu/hr*
Fan Control	144(c)	*Constant Volume*	*Constant Volume*	*Constant Volume*
DP Sensor Location	144(c)			
Supply Pressure Reset (DDC only)	144(c)	*Yes*	*Yes*	*Yes*
Simultaneous Heat/Cool	144(d)	*No*	*No*	*No*
Economizer	144(e)	*No Economizer*	*No Economizer*	*No Economizer*
Heat Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Cool Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Electric Resistance Heating[1]	144(g)			
Air Cooled Chiller Limitation	144(i)			
Duct Leakage Sealing. If Yes, a MECH-4-A must be submitted	144(k)	*No*	*No*	*No*

1. Total installed capacity (MBtu/hr) of all electric heat on this project exclusive of electric auxiliary heat for heat pumps. If electric heat is used explain which exception(s) to §144(g) apply.

AIR SYSTEM REQUIREMENTS (Part 1 of 2) MECH-2C

Project Name	Date
HCC Bldg. D	*10/27/2011*

Item or System Tags (i.e. AC-1, RTU-1, HP-1)		Indicate Air Systems Type (Central, Single Zone, Package, VAV, or etc...)		
		AC-D-2	*AC-D-1*	*AC-D-3*
Number of Systems		*1*	*1*	*1*
MANDATORY MEASURES	**T-24 Sections**	**Indicate Page Reference on Plans or Schedule and indicate the applicable exception(s)**		
Heating Equipment Efficiency	112(a)	*80% AFUE*	*80% AFUE*	*81% AFUE*
Cooling Equipment Efficiency	112(a)	*12.7 EER*	*12.0 SEER / 12.7 EER*	*12.0 SEER / 12.8 EER*
HVAC Heat Pump Thermostat	112(b), 112(c)	*n/a*	*n/a*	*n/a*
Furnace Controls/Thermostat	112(c), 115(a)	*n/a*	*n/a*	*n/a*
Natural Ventilation	121(b)	*Yes*	*Yes*	*Yes*
Mechanical Ventilation	121(b)	*478 cfm*	*329 cfm*	*595 cfm*
VAV Minimum Position Control	121(c)	*No*	*No*	*No*
Demand Control Ventilation	121(c)	*Yes*	*Yes*	*Yes*
Time Control	122(e)	*Programmable Switch*	*Programmable Switch*	*Programmable Switch*
Setback and Setup Control	122(e)	*Setback Required*	*Setback Required*	*Setback Required*
Outdoor Damper Control	122(f)	*Auto*	*Auto*	*Auto*
Isolation Zones	122(g)	*n/a*	*n/a*	*n/a*
Pipe Insulation	123			
Duct Location/ R-value	124	*Attic, Ceiling Ins, vented / 8.0*	*Attic, Ceiling Ins, vented / 8.0*	*Attic, Ceiling Ins, vented / 8.0*
PRESCRIPTIVE MEASURES				
Calculated Design Heating Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Heating Capacity	144(a & b)	*64,000 Btu/hr*	*48,000 Btu/hr*	*48,000 Btu/hr*
Calculated Design Cooling Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Cooling Capacity	144(a & b)	*50,432 Btu/hr*	*42,066 Btu/hr*	*45,956 Btu/hr*
Fan Control	144(c)	*Constant Volume*	*Constant Volume*	*Constant Volume*
DP Sensor Location	144(c)			
Supply Pressure Reset (DDC only)	144(c)	*Yes*	*Yes*	*Yes*
Simultaneous Heat/Cool	144(d)	*No*	*No*	*No*
Economizer	144(e)	*Fixed Temp (Integrated)*	*No Economizer*	*No Economizer*
Heat Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Cool Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Electric Resistance Heating[1]	144(g)			
Air Cooled Chiller Limitation	144(i)			
Duct Leakage Sealing. If Yes, a MECH-4-A must be submitted	144(k)	*No*	*No*	*No*

1. Total installed capacity (MBtu/hr) of all electric heat on this project exclusive of electric auxiliary heat for heat pumps. If electric heat is used explain which exception(s) to §144(g) apply.

AIR SYSTEM REQUIREMENTS (Part 1 of 2) MECH-2C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

Item or System Tags (i.e. AC-1, RTU-1, HP-1)		Indicate Air Systems Type (Central, Single Zone, Package, VAV, or etc...)		
		CU/ACC-D-1	*CU/ACC-D-3*	*CU/ACC-D-4*
Number of Systems		*1*	*1*	*1*
MANDATORY MEASURES	**T-24 Sections**	**Indicate Page Reference on Plans or Schedule and indicate the applicable exception(s)**		
Heating Equipment Efficiency	112(a)	*12.00 HSPF*	*12.00 HSPF*	*12.00 HSPF*
Cooling Equipment Efficiency	112(a)	*0.0 SEER / 14.5 EER*	*0.0 SEER / 14.5 EER*	*0.0 SEER / 14.5 EER*
HVAC Heat Pump Thermostat	112(b), 112(c)	*Yes*	*Yes*	*Yes*
Furnace Controls/Thermostat	112(c), 115(a)	*n/a*	*n/a*	*n/a*
Natural Ventilation	121(b)	*No*	*No*	*No*
Mechanical Ventilation	121(b)	*30 cfm*	*32 cfm*	*35 cfm*
VAV Minimum Position Control	121(c)	*No*	*No*	*No*
Demand Control Ventilation	121(c)	*Yes*	*Yes*	*Yes*
Time Control	122(e)	*Programmable Switch*	*Programmable Switch*	*Programmable Switch*
Setback and Setup Control	122(e)	*Setback Required*	*Setback Required*	*Setback Required*
Outdoor Damper Control	122(f)	*Auto*	*Auto*	*Auto*
Isolation Zones	122(g)	*n/a*	*n/a*	*n/a*
Pipe Insulation	123			
Duct Location/ R-value	124	*Attic, Ceiling Ins, vented / 8.0*	*Attic, Ceiling Ins, vented / 8.0*	*Attic, Ceiling Ins, vented / 8.0*
PRESCRIPTIVE MEASURES				
Calculated Design Heating Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Heating Capacity	144(a & b)	*8,919 Btu/hr*	*8,919 Btu/hr*	*8,919 Btu/hr*
Calculated Design Cooling Load	144(a & b)	*n/a*	*n/a*	*n/a*
Proposed Cooling Capacity	144(a & b)	*10,796 Btu/hr*	*10,851 Btu/hr*	*10,846 Btu/hr*
Fan Control	144(c)	*Constant Volume*	*Constant Volume*	*Constant Volume*
DP Sensor Location	144(c)			
Supply Pressure Reset (DDC only)	144(c)	*Yes*	*Yes*	*Yes*
Simultaneous Heat/Cool	144(d)	*No*	*No*	*No*
Economizer	144(e)	*No Economizer*	*No Economizer*	*No Economizer*
Heat Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Cool Air Supply Reset	144(f)	*Constant Temp*	*Constant Temp*	*Constant Temp*
Electric Resistance Heating[1]	144(g)			
Air Cooled Chiller Limitation	144(i)			
Duct Leakage Sealing. If Yes, a MECH-4-A must be submitted	144(k)	*No*	*No*	*No*

1. Total installed capacity (MBtu/hr) of all electric heat on this project exclusive of electric auxiliary heat for heat pumps. If electric heat is used explain which exception(s) to §144(g) apply.

WATER SIDE SYSTEM REQUIREMENTS (Part 2 of 2) MECH-2C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

	WATER[2] SIDE SYSTEMS: Chillers, Towers, Boilers, Hydronic Loops			
Item or System Tags (i.e. AC-1, RTU-1, HP-1)[1]				
Number of Systems				
	Indicate Page Reference on Plans or Specification[2]			
MANDATORY MEASURES	**T-24 Sections**			
Equipment Efficiency	112(a)			
Pipe Insulation	123			
PRESCRIPTIVE MEASURES				
Cooling Tower Fan Controls	144(a & b)			
Cooling Tower Flow Controls	144(h)			
Variable Flow System Design	144(h)			
Chiller and Boiler Isolation	144(j)			
CHW and HHW Reset Controls	144(j)			
WLHP Isolation Valves	144(j)			
VSD on CHW, CW & WLHP Pumps>5HP	144(j)			
DP Sensor Location	144(j)			

1. The proposed equipment need to match the building plans schedule or specifications. If a requirement is not applicable, put "N/A" in the column next to applicable section.
2. For each chiller, cooling tower, boiler, and hydronic loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column next to applicable section.

	Service Hot Water, Pool Heating			
Item or System Tags (i.e. WH-1, WHP, DHW, etc...)[1]	*DHW Heater*			
Number of Systems	*1*			
	Indicate Page Reference on Plans or Schedule[2]			
MANDATORY MEASURES	**T-24 Sections**			
SERVICE HOT WATER				
Certified Water Heater	111, 113(a)	*Rinnai # RC98HPI-NG*		
Water Heater Efficiency	113(b)	*0.85 EF*		
Service Water Heating Installation	113(c)	*Controls Req.*		
Pipe Insulation	123	*n/a*		
POOL AND SPA				
Pool and Spa Efficiency and Control	114(a)	*n/a*		
Pool and Spa Installation	114(b)	*n/a*		
Pool Heater – No Pilot Light	115(c)	*n/a*		
Spa Heater – No Pilot Light	115(d)	*n/a*		
Pipe Insulation	123	*Required*		

1. The Proposed equipment needs to match the building plans schedule or specifications. If a requirement is not applicable, put "N/A" in the column next to applicable section.
2. For each water heater, pool heater and domestic water loop (or groups of similar equipment) fill in the reference to sheet number and/or specification section and paragraph number where the required features are documented. If a requirement is not applicable, put "N/A" in the column.

MECHANICAL VENTILATION AND REHEAT

MECH-3C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

	MECHANICAL VENTILATION (§121(b)2)								REHEAT LIMITATION (§144(d)) VAV MINIMUM				
	AREA BASIS			OCCUPANCY BASIS									
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone/System	Condition Area (ft^2)	CFM per ft^2	Min CFM By Area B X C	Number Of People	CFM per Person	Min CFM by Occupant E X F	REQ'D V.A. Max of D or G	Design Ventilation Air CFM	50% of Design Zone Supply CFM	B X 0.4 CFM / ft^2	Max. of Columns H, J, K, 300 CFM	Design Minimum Air Setpoint	Transfer Air
Zone -4	*714*	*0.38*	*271*	*39.7*	*15.0*	*595*	*595*	*595*					
Zone- 4A	*440*	*0.15*	*66*	*1.3*	*0.0*	*0*	*66*	*0*					*66*
AC-D-4						*Total*	*661*	*595*					
Zone-7	*213*	*0.50*	*107*	*2.1*	*15.0*	*32*	*107*	*32*					*75*
CU/ACC-D-2						*Total*	*107*	*32*					
Zone-5	*714*	*0.38*	*271*	*39.7*	*15.0*	*595*	*595*	*595*					
Zone- 5A	*242*	*0.15*	*36*	*3.5*	*15.0*	*53*	*53*	*53*					
Zone -5B	*314*	*0.15*	*47*				*47*	*47*					
AC-D-5						*Total*	*695*	*695*					
Zone-2	*1,077*	*0.50*	*539*	*21.5*	*15.0*	*323*	*539*	*323*					*215*
Zone -2A	*314*	*0.15*	*47*				*47*	*47*					
Zone- 2B	*586*	*0.15*	*88*	*7.2*	*15.0*	*108*	*108*	*108*					
AC-D-2						*Total*	*694*	*478*					
Zone-1	*1,034*	*0.38*	*393*	*21.1*	*15.0*	*317*	*393*	*317*					*76*
Zone-1A	*40*	*0.15*	*6*	*0.8*	*15.0*	*12*	*12*	*12*					
			Totals						Column I Total Design Ventilation Air				

C	Minimum ventilation rate per Section §121, Table 121-A.
E	Based on fixed seat or the greater of the expected number of occupants and 50% of the CBC occupant load for egress purposes for spaces without fixed seating.
H	Required Ventilation Air (REQ'D V.A.) is the larger of the ventilation rates calculated on an AREA BASIS or OCCUPANCY BASIS (Column D or G).
I	Must be greater than or equal to H, or use Transfer Air (column N) to make up the difference.
J	Design fan supply CFM (Fan CFM) x 50%; or the design zone outdoor airflow rate per §121.
K	Condition area (ft^2) x 0.4 CFM / ft^2; or
L	Maximum of Columns H, J, K, or 300 CFM
M	This must be less than or equal to Column L and greater than or equal to the sum of Columns H plus N.
N	Transfer Air must be provided where the Required Ventilation Air (Column H) is greater than the Design Minimum Air (Column M). Where required, transfer air must be greater than or equal to the difference between the Required Ventilation Air (Column H) and the Design Minimum Air (Column M), Column H minus M.

MECHANICAL VENTILATION AND REHEAT

MECH-3C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

	MECHANICAL VENTILATION (§121(b)2)								REHEAT LIMITATION (§144(d)) VAV MINIMUM				
	AREA BASIS			OCCUPANCY BASIS									
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Zone/System	Condition Area (ft^2)	CFM per ft^2	Min CFM By Area B X C	Number Of People	CFM per Person	Min CFM by Occupant E X F	REQ'D V.A. Max of D or G	Design Ventilation Air CFM	50% of Design Zone Supply CFM	B X 0.4 CFM / ft^2	Max. of Columns H, J, K, 300 CFM	Design Minimum Air Setpoint	Transfer Air
AC-D-1						*Total*	*405*	*329*					
Zone -3	*714*	*0.38*	*271*	*39.7*	*15.0*	*595*	*595*	*595*					
AC-D-3						*Total*	*595*	*595*					
Zone 6	*236*	*0.50*	*118*	*2.0*	*15.0*	*30*	*118*	*30*					*88*
CU/ACC-D-1						*Total*	*118*	*30*					
Zone 8	*213*	*0.50*	*107*	*2.1*	*15.0*	*32*	*107*	*32*					*75*
CU/ACC-D-3						*Total*	*107*	*32*					
Zone 9	*236*	*0.50*	*118*	*2.4*	*15.0*	*35*	*118*	*35*					*83*
CU/ACC-D-4						*Total*	*118*	*35*					
			Totals						Column I Total Design Ventilation Air				

C	Minimum ventilation rate per Section §121, Table 121-A.
E	Based on fixed seat or the greater of the expected number of occupants and 50% of the CBC occupant load for egress purposes for spaces without fixed seating.
H	Required Ventilation Air (REQ'D V.A.) is the larger of the ventilation rates calculated on an AREA BASIS or OCCUPANCY BASIS (Column D or G).
I	Must be greater than or equal to H, or use Transfer Air (column N) to make up the difference.
J	Design fan supply CFM (Fan CFM) x 50%; or the design zone outdoor airflow rate per §121.
K	Condition area (ft^2) x 0.4 CFM / ft^2; or
L	Maximum of Columns H, J, K, or 300 CFM
M	This must be less than or equal to Column L and greater than or equal to the sum of Columns H plus N.
N	Transfer Air must be provided where the Required Ventilation Air (Column H) is greater than the Design Minimum Air (Column M). Where required, transfer air must be greater than or equal to the difference between the Required Ventilation Air (Column H) and the Design Minimum Air (Column M), Column H minus M.

MECHANICAL EQUIPMENT DETAILS (Part 1 of 2) MECH-5C

Project Name: *HCC Bldg. D*

Date: *10/27/2011*

CHILLER AND TOWER SUMMARY

Equipment Name	Type	Qty.	Efficiency	Tons	PUMPS Qty.	PUMPS GPM	PUMPS BHP	PUMPS Pump Control

DHW / BOILER SUMMARY

System Name	Type	Distribution	Qty.	Rated Input	Vol. (Gals).	Energy Factor or RE	Standby Loss or Pilot	Tank Ext. R-Value	Status
Rinnai # RC98HPI-NG	*Instant Gas*	*Kitchen Pipe Ins*	*1*	*199,000*	*0*	*0.85*	*n/a*	*n/a*	*New*

MULTI-FAMILY CENTRAL WATER HEATING DETAILS

Hot Water Pump Control	Hot Water Pump Qty.	Hot Water Pump HP	Hot Water Pump Type	Hot Water Piping Length (ft) In Plenum	Outside	Buried	Add ½" Insulation
							☐
							☐
							☐

CENTRAL SYSTEM RATINGS

System Name	Type	Qty.	HEATING Output	HEATING Aux. kW	HEATING Efficiency	COOLING Output	COOLING Efficiency	Status
Trane YHC-060	*Packaged DX*	*3*	*48,000*	*0.0*	*80% AFUE*	*62,400*	*12.0 SEER / 12.7 EER*	*New*
12RLS/AOU112RLS	*Split DX*	*4*	*16,000*	*0.0*	*12.00 HSPF*	*12,000*	*0.0 SEER / 14.5 EER*	*New*
Trane YHC-072	*Packaged DX*	*1*	*64,000*	*0.0*	*80% AFUE*	*72,500*	*12.7 EER*	*New*
Trane YHC-048	*Split DX*	*1*	*48,000*	*0.0*	*81% AFUE*	*49,450*	*12.0 SEER / 12.8 EER*	*New*

CENTRAL SYSTEM FAN SUMMARY

System Name	Fan Type	Economizer Type	SUPPLY FAN CFM	SUPPLY FAN BHP	RETURN FAN CFM	RETURN FAN BHP
Trane YHC-060	*Constant Volume*	*No Economizer*	*2,000*	*1.00*	*none*	
12RLS/AOU112RLS	*Constant Volume*	*No Economizer*	*430*	*0.32*	*none*	
Trane YHC-072	*Constant Volume*	*Fixed Temp (Integrated)*	*2,500*	*1.00*	*none*	
Trane YHC-048	*Constant Volume*	*No Economizer*	*1,600*	*0.32*	*none*	

MECHANICAL EQUIPMENT DETAILS (Part 2 of 2) MECH-5C

Project Name: HCC Bldg. D
Date: 10/27/2011

ZONE SYSTEM SUMMARY

		SYSTEM				VAV		Fan				
Zone Name	System Name	Type	Qty.	Heating	Cooling	Min CFM Ratio	Reheat Coil	CFM	BHP	Fan Cycles	ECM Motor	Outside Air
Zone-5	CAV Box/No Reheat	VAV Box	1	0		100 %	None			☐	☐	
Zone-1	CAV Box/No Reheat	VAV Box	1	0		100 %	None			☐	☐	
Zone-1A	CAV Box/No Reheat	VAV Box	1	0		100 %	None			☐	☐	
										☐	☐	
										☐	☐	
										☐	☐	
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										☐	☐	
										☐	☐	

EXHAUST FAN SUMMARY

EXHAUST FAN				EXHAUST FAN				EXHAUST FAN			
Room Name	Qty.	CFM	BHP	Room Name	Qty.	CFM	BHP	Room Name	Qty.	CFM	BHP

ENVELOPE MANDATORY MEASURES: NONRESIDENTIAL — ENV-MM

Project Name	Date
HCC Bldg. D	*10/27/2011*

DESCRIPTION

Building Envelope Measures:

§118(a):	Installed insulating material shall have been certified by the manufacturer to comply with the California Quality Standards for insulating material, Title 20 Chapter 4, Article 3.
§118(c):	All Insulating Materials shall be installed in compliance with the flame spread rating and smoke density requirements of Sections 2602 and 707 of Title 24, Part 2.
§118(f):	The opaque portions of framed demising walls in nonresidential buildings shall have insulation with an installed R-value of no less than R-13 between framing members.
§117(a):	All Exterior Joints and openings in the building that are observable sources of air leakage shall be caulked, gasketed, weatherstripped or otherwise sealed.
§116(a) 1:	Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft.^{2} of window area, 0.3 cfm/ft.^{2} of door area for residential doors, 0.3 cfm/ft.^{2} of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft.^{2} for nonresidential double doors (swinging).
§116(a) 2:	Fenestration U-factor shall be rated in accordance with NFRC 100, or the applicable default U-factor.
§116(a) 3:	Fenestration SHGC shall be rated in accordance with NFRC 200, or NFRC 100 for site-built fenestration, or the applicable default SHGC.
§116(b):	Site Constructed Doors, Windows and Skylights shall be caulked between the unit and the building, and shall be weatherstripped (except for unframed glass doors and fire doors).

LIGHTING MANDATORY MEASURES: NONRESIDENTIAL — LTG-MM

Project Name	Date
HCC Bldg. D	*10/27/2011*

Indoor Lighting Measures:

§131(d):	**Shut-off Controls**
1.	For every floor, all interior lighting systems shall be equipped with a separate automatic control to shut off the lighting. This automatic control shall meet the requirements of Section 119 and may be an occupancy sensor, automatic time switch, or other device capable of automatically shutting off the lighting.
2.	Override for Building Lighting Shut-off: The automatic building shut-off system is provided with a manual, accessible override switch in sight of the lights. The area of override is not to exceed 5,000 square feet.
§119(h):	Automatic Control Devices Certified: All automatic control devices specified are certified, all alternate equipment shall be certified and installed as directed by the manufacturer.
§111:	Fluorescent Ballast and Luminaires Certified: All fluorescent fixtures specified for the project are certified and listed in the Directory. All installed fixtures shall be certified.
§131(a):	Individual Room/Area Controls: Each room and area in this building is equipped with a separate switch or occupancy sensor device for each area with floor-to-ceiling walls.
§131(b):	Uniform Reduction for Individual Rooms: All rooms and areas greater than 100 square feet and more than 0.8 watts per square foot of lighting load shall be controlled with bi-level switching for uniform reduction of lighting within the room.
§131(c):	Daylight Area Control: All rooms with windows and skylights that are greater than 250 square feet and that allow for the effective use of daylight in the area shall have 50% of the lamps in each daylit area controlled by a separate switch; or the effective use of daylight cannot be accomplished because the windows are continuously shaded by a building on the adjacent lot. Diagram of shading during different times of the year is included on plans.
§131(c):	Display Lighting. Display lighting shall be separately switched on circuits that are 20 amps or less.6.

Outdoor Lighting Measures:

§130(c)1:	Mandatory lighting power determination for medium base sockets without permanently installed ballasts
§132(a):	All permanently installed luminaires with lamps rated over 100 Watts either have a lamp efficacy of at least 60 lumens per Watt or are controlled by a motion sensor.
§132(b):	All Luminaires with lamps rated greater than 175 Watts in hardscape area, including parking lots, building entrances, canopies, and all outdoor sales areas meet the Cutoff Requirements.
§132(c)1:	All permanently installed outdoor lighting meets the control requirements listed.
§132(c):	Building facades, parking lots, garages, canopies, and outdoor sales areas meet the Multi-Level Lighting Requirements listed.

MECHANICAL MANDATORY MEASURES: NONRESIDENTIAL — MECH-MM

Project Name	Date
HCC Bldg. D	*10/27/2011*

Equipment and System Efficiencies

§111:	Any appliance for which there is a California standard established in the Appliance Efficiency Regulations will comply with the applicable standard.
§115(a):	Fan type central furnaces shall not have a pilot light.
§123:	Piping, except that conveying fluids at temperatures between 60 and 105 degrees Fahrenheit, or within HVAC equipment, shall be insulated in accordance with Standards Section 123.
§124:	Air handling duct systems shall be installed and insulated in compliance with Sections 601, 602, 603, 604, and 605 of the CMC Standards.

Controls

§122(e):	Each space conditioning system shall be installed with one of the following:
1A.	Each space conditioning system serving building types such as offices and manufacturing facilities (and all others not explicitly exempt from the requirements of Section 112 (d)) shall be installed with an automatic time switch with an accessible manual override that allows operation of the system during off-hours for up to 4 hours. The time switch shall be capable of programming different schedules for weekdays and weekends and have program backup capabilities that prevent the loss of the device's program and time setting for at least 10 hours if power is interrupted; or
1B.	An occupancy sensor to control the operating period of the system; or
1C.	A 4-hour timer that can be manually operated to control the operating period of the system.
2.	Each space conditioning system shall be installed with controls that temporarily restart and temporarily operate the system as required to maintain a setback heating and/or a setup cooling thermostat setpoint.
§122(g):	Each space conditioning system serving multiple zones with a combined conditioned floor area more than 25,000 square feet shall be provided with isolation zones. Each zone: shall not exceed 25,000 square feet; shall be provided with isolation devices, such as valves or dampers that allow the supply of heating or cooling to be setback or shut off independently of other isolation areas; and shall be controlled by a time control device as described above.
§122(c):	Thermostats shall have numeric setpoints in degrees Fahrenheit (F) and adjustable setpoint stops accessible only to authorized personnel.
§122(b):	Heat pumps shall be installed with controls to prevent electric resistance supplementary heater operation when the heating load can be met by the heat pump alone
§122(a&b):	Each space conditioning system shall be controlled by an individual thermostat that responds to temperature within the zone. Where used to control heating, the control shall be adjustable down to 55 degrees F or lower. For cooling, the control shall be adjustable up to 85 degrees F or higher. Where used for both heating and cooling, the control shall be capable of providing a deadband of at least 5 degrees F within which the supply of heating and cooling is shut off or reduced to a minimum.

Ventilation

§121(e):	Controls shall be provided to allow outside air dampers or devices to be operated at the ventilation rates as specified on these plans.
§122(f):	All gravity ventilating systems shall be provided with automatic or readily accessible manually operated dampers in all openings to the outside, except for combustion air openings.
§121(f):	Ventilation System Acceptance. Before an occupancy permit is granted for a newly constructed building or space, or a new ventilating system serving a building or space is operated for normal use, all ventilation systems serving the building or space shall be certified as meeting the Acceptance Requirements for Code Compliance

Service Water Heating Systems

§113(c)	Installation
3.	Temperature controls for public lavatories. The controls shall limit the outlet Temperature to 110° F.
2.	Circulating service water-heating systems shall have a control capable of automatically turning off the circulating pump when hot water is not required.

HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-4	1,154

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	48,000
Total Output (Btuh)	48,000
Output (Btuh/sqft)	41.6
Cooling System	
Output per System	62,400
Total Output (Btuh)	62,400
Total Output (Tons)	5.2
Total Output (Btuh/sqft)	54.1
Total Output (sqft/Ton)	221.9
Air System	
CFM per System	2,000
Airflow (cfm)	2,000
Airflow (cfm/sqft)	1.73
Airflow (cfm/Ton)	384.6
Outside Air (%)	29.8 %
Outside Air (cfm/sqft)	0.52
Note: values above given at ARI conditions	

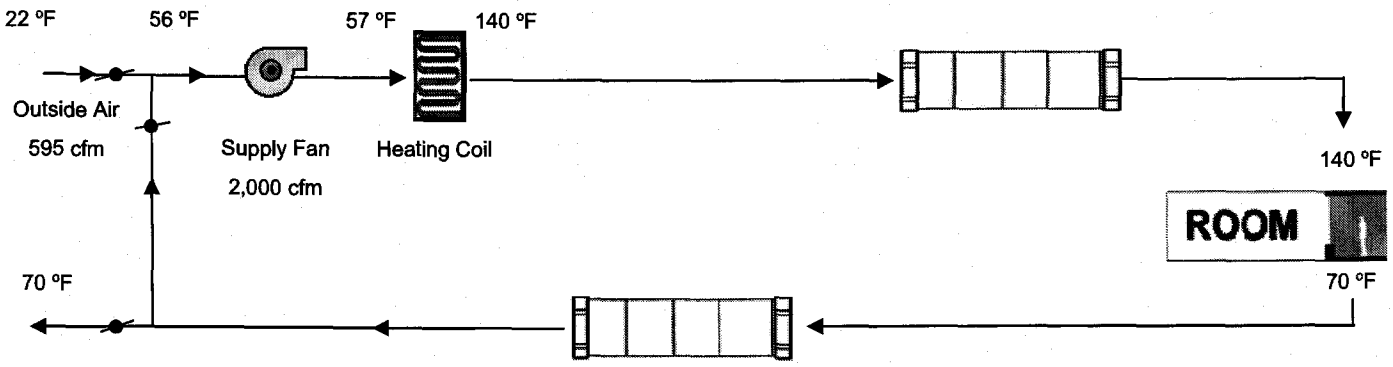
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	1,252	19,991	8,376	160	11,864
Return Vented Lighting		0			
Return Air Ducts		1,000			593
Return Fan		0			0
Ventilation	595	11,994	-1,807	595	30,117
Supply Fan		3,070			-3,070
Supply Air Ducts		1,000			593
TOTAL SYSTEM LOAD		37,054	6,569		40,098

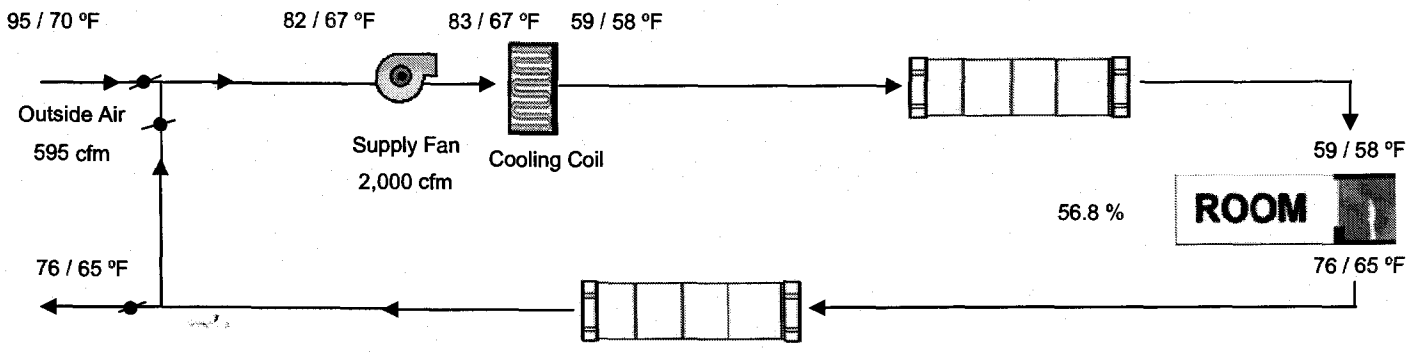
HVAC EQUIPMENT SELECTION

Trane YHC-060	51,148	11,328		48,000
Total Adjusted System Output (Adjusted for Peak Design conditions)	51,148	11,328		48,000
TIME OF SYSTEM PEAK	Jul 3 PM			Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	Floor Area
CU/ACC-D-2	213

ENGINEERING CHECKS	
Number of Systems	1
Heating System	
Output per System	16,000
Total Output (Btuh)	16,000
Output (Btuh/sqft)	75.1
Cooling System	
Output per System	12,000
Total Output (Btuh)	12,000
Total Output (Tons)	1.0
Total Output (Btuh/sqft)	56.3
Total Output (sqft/Ton)	213.0
Air System	
CFM per System	430
Airflow (cfm)	430
Airflow (cfm/sqft)	2.02
Airflow (cfm/Ton)	430.0
Outside Air (%)	7.4 %
Outside Air (cfm/sqft)	0.15
Note: values above given at ARI conditions	

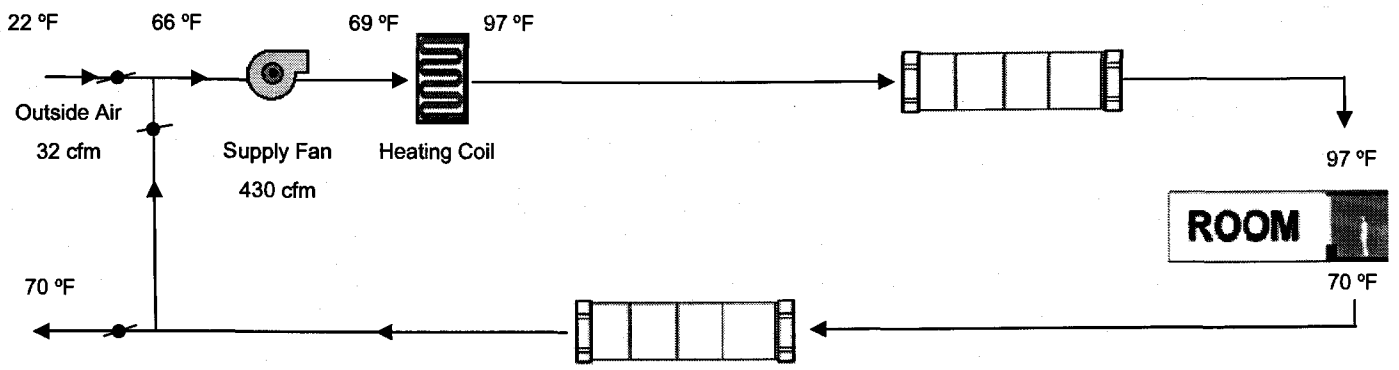
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	189	3,729	439	119	3,366
Return Vented Lighting		0			
Return Air Ducts		186			168
Return Fan		0			0
Ventilation	32	579	219	32	1,614
Supply Fan		1,312			-1,312
Supply Air Ducts		186			168
TOTAL SYSTEM LOAD		5,993	658		4,005

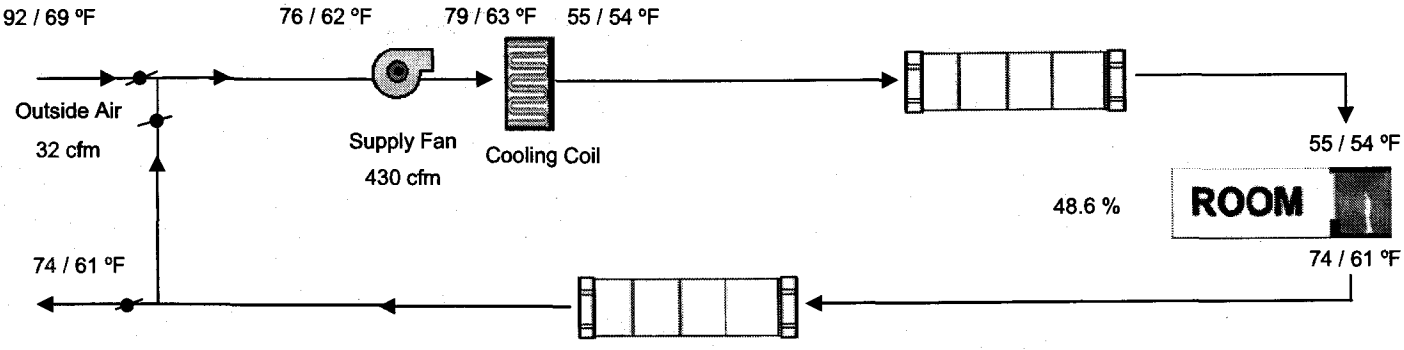
HVAC EQUIPMENT SELECTION

12RLS/AOU112RLS	10,824	652		8,919
Total Adjusted System Output (Adjusted for Peak Design conditions)	10,824	652		8,919
TIME OF SYSTEM PEAK	Jul 5 PM			Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-5	1,270

ENGINEERING CHECKS	
Number of Systems	1
Heating System	
Output per System	48,000
Total Output (Btuh)	48,000
Output (Btuh/sqft)	37.8
Cooling System	
Output per System	62,400
Total Output (Btuh)	62,400
Total Output (Tons)	5.2
Total Output (Btuh/sqft)	49.1
Total Output (sqft/Ton)	244.2
Air System	
CFM per System	2,000
Airflow (cfm)	2,000
Airflow (cfm/sqft)	1.57
Airflow (cfm/Ton)	384.6
Outside Air (%)	34.7 %
Outside Air (cfm/sqft)	0.55
Note: values above given at ARI conditions	

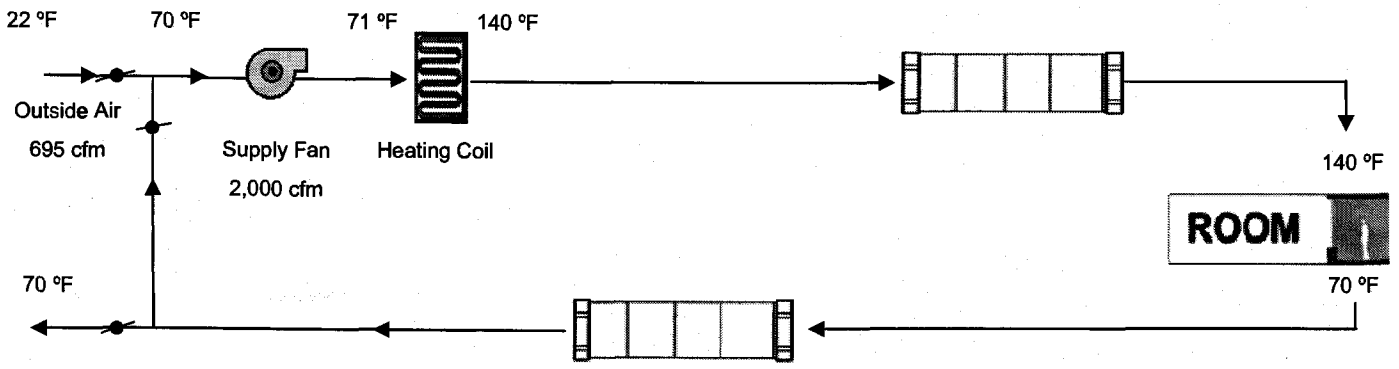
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	1,450	22,257	9,831	189	13,934
Return Vented Lighting		0			
Return Air Ducts		1,113			697
Return Fan		0			0
Ventilation	695	0	0	695	0
Supply Fan		3,070			-3,070
Supply Air Ducts		1,113			697
TOTAL SYSTEM LOAD		27,553	9,831		12,257

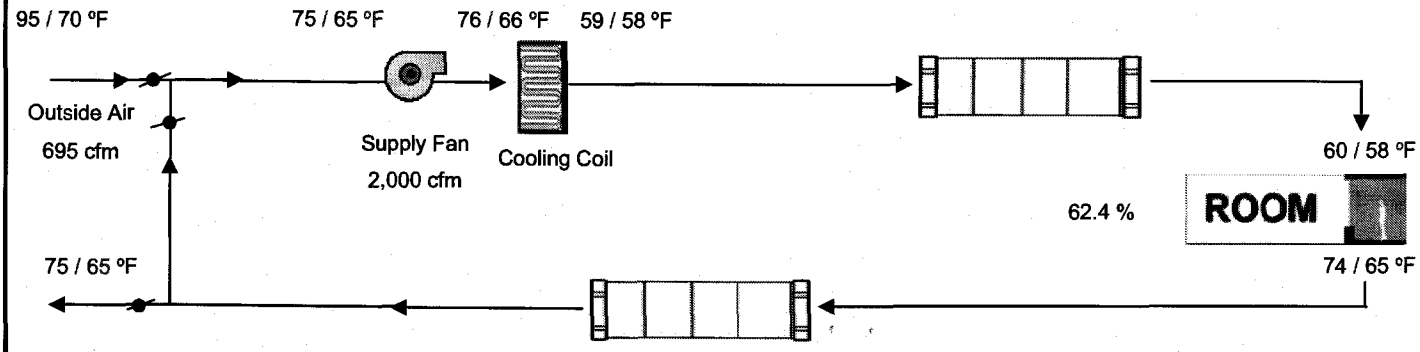
HVAC EQUIPMENT SELECTION

Trane YHC-060	40,207	21,003		48,000
Total Adjusted System Output (Adjusted for Peak Design conditions)	40,207	21,003		48,000
TIME OF SYSTEM PEAK	Jul 3 PM			Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-2	1,977

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	64,000
Total Output (Btuh)	64,000
Output (Btuh/sqft)	32.4
Cooling System	
Output per System	72,500
Total Output (Btuh)	72,500
Total Output (Tons)	6.0
Total Output (Btuh/sqft)	36.7
Total Output (sqft/Ton)	327.2
Air System	
CFM per System	2,500
Airflow (cfm)	2,500
Airflow (cfm/sqft)	1.26
Airflow (cfm/Ton)	413.8
Outside Air (%)	19.1 %
Outside Air (cfm/sqft)	0.24
Note: values above given at ARI conditions	

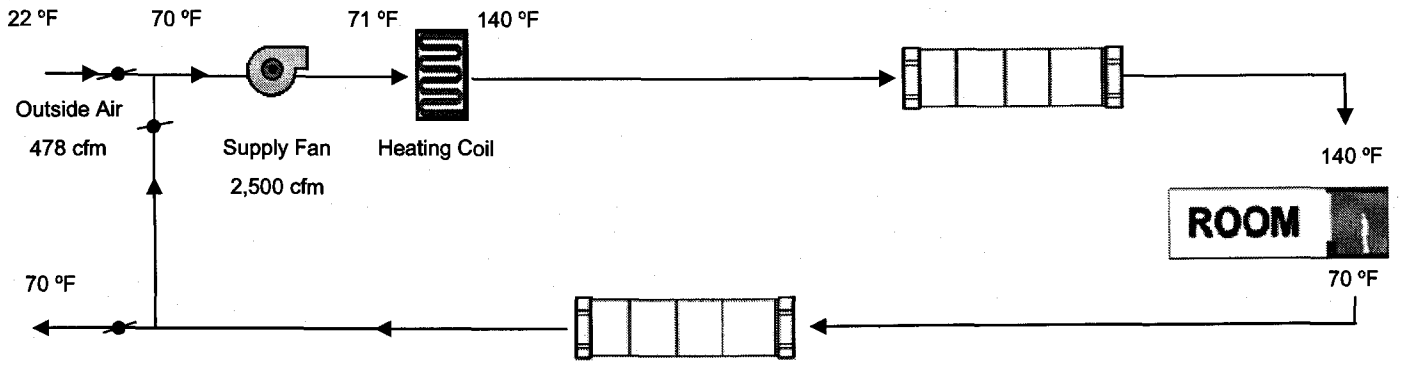
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	1,651	25,426	7,022	241	17,821
Return Vented Lighting		0			
Return Air Ducts		1,271			891
Return Fan		0			0
Ventilation	478	0	0	478	0
Supply Fan		3,070			-3,070
Supply Air Ducts		1,271			891
TOTAL SYSTEM LOAD		31,039	7,022		16,533

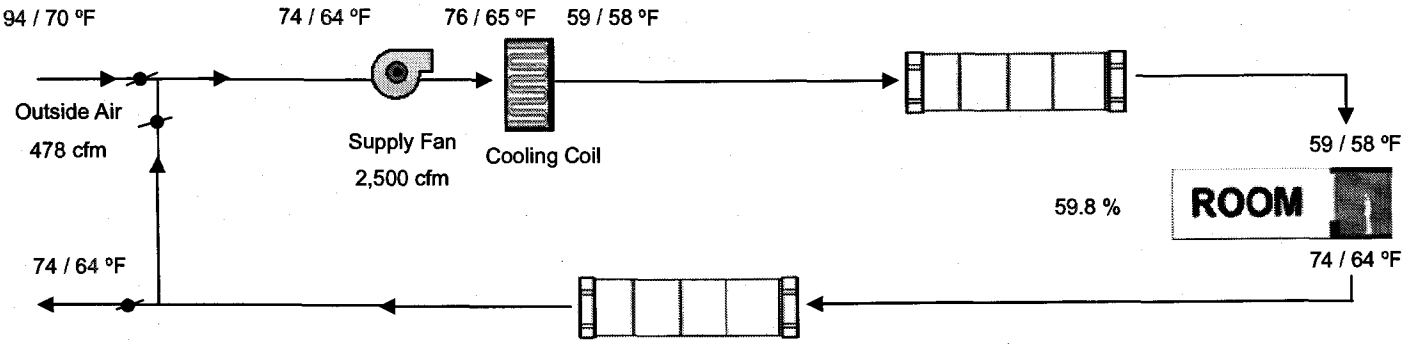
HVAC EQUIPMENT SELECTION

Trane YHC-072		50,432	20,158	64,000
Total Adjusted System Output (Adjusted for Peak Design conditions)		50,432	20,158	64,000
TIME OF SYSTEM PEAK		Jul 2 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-1	1,074

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	48,000
Total Output (Btuh)	48,000
Output (Btuh/sqft)	44.7
Cooling System	
Output per System	62,400
Total Output (Btuh)	62,400
Total Output (Tons)	5.2
Total Output (Btuh/sqft)	58.1
Total Output (sqft/Ton)	206.5
Air System	
CFM per System	2,000
Airflow (cfm)	2,000
Airflow (cfm/sqft)	1.86
Airflow (cfm/Ton)	384.6
Outside Air (%)	16.4 %
Outside Air (cfm/sqft)	0.31
Note: values above given at ARI conditions	

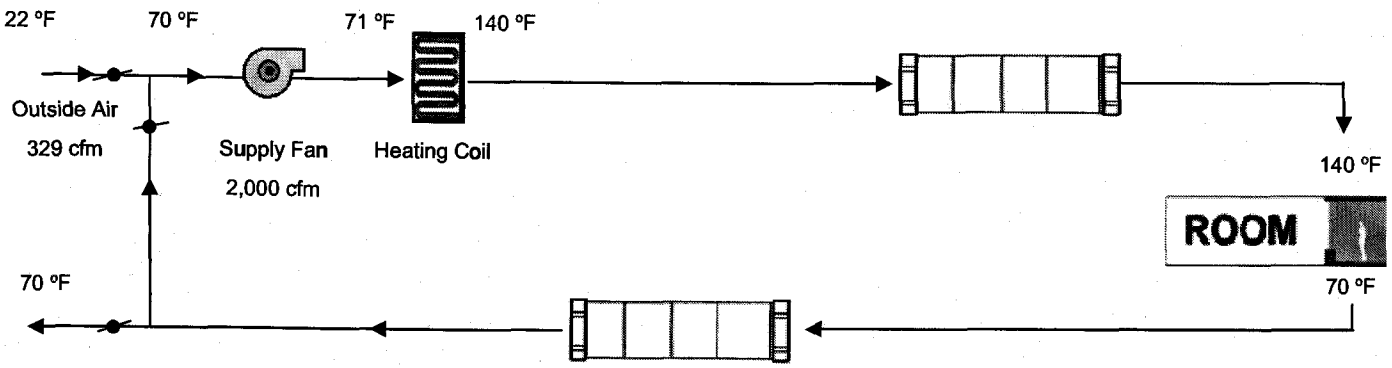
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	1,170	18,086	4,515	138	10,197
Return Vented Lighting		0			
Return Air Ducts		904			510
Return Fan		0			0
Ventilation	329	0	0	329	0
Supply Fan		3,070			-3,070
Supply Air Ducts		904			510
TOTAL SYSTEM LOAD		22,965	4,515		8,147

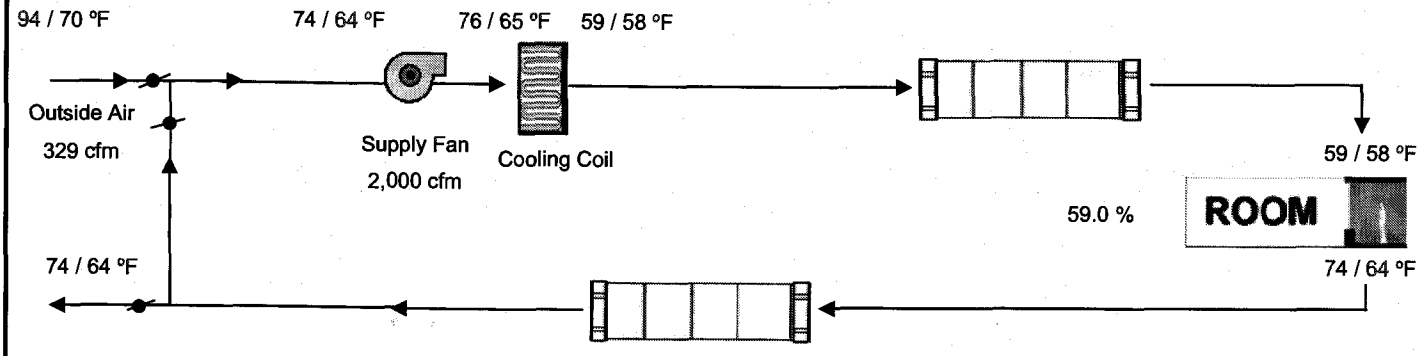
HVAC EQUIPMENT SELECTION

Trane YHC-060		42,066	18,569	48,000
Total Adjusted System Output (Adjusted for Peak Design conditions)		42,066	18,569	48,000
TIME OF SYSTEM PEAK		Aug 2 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	Floor Area
AC-D-3	714

ENGINEERING CHECKS	
Number of Systems	1
Heating System	
Output per System	48,000
Total Output (Btuh)	48,000
Output (Btuh/sqft)	67.2
Cooling System	
Output per System	49,450
Total Output (Btuh)	49,450
Total Output (Tons)	4.1
Total Output (Btuh/sqft)	69.3
Total Output (sqft/Ton)	173.3
Air System	
CFM per System	1,600
Airflow (cfm)	1,600
Airflow (cfm/sqft)	2.24
Airflow (cfm/Ton)	388.3
Outside Air (%)	37.2 %
Outside Air (cfm/sqft)	0.83
Note: values above given at ARI conditions	

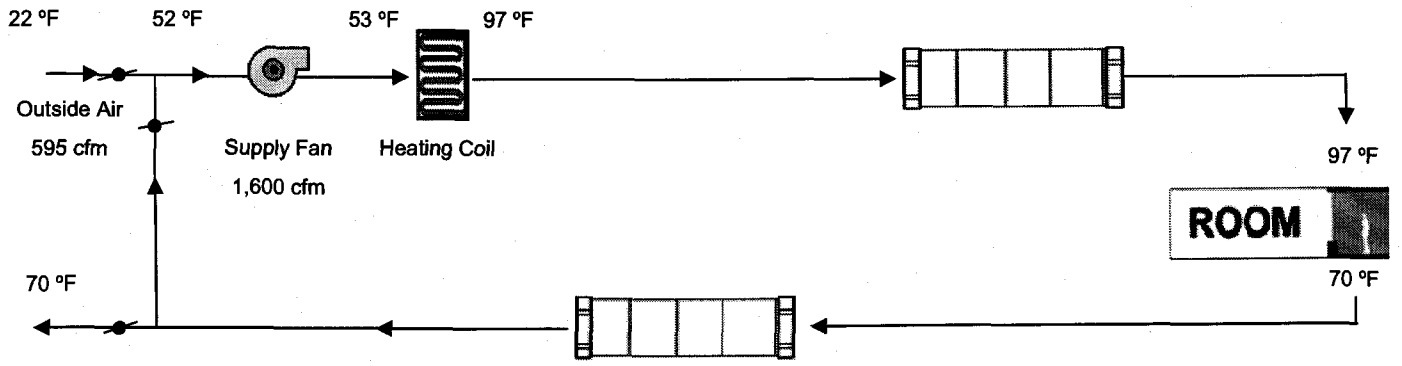
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	1,108	21,581	8,171	552	15,529
Return Vented Lighting		0			
Return Air Ducts		1,079			776
Return Fan		0			0
Ventilation	595	12,852	1,691	595	30,005
Supply Fan		1,312			-1,312
Supply Air Ducts		1,079			776
TOTAL SYSTEM LOAD		37,904	9,863		45,775

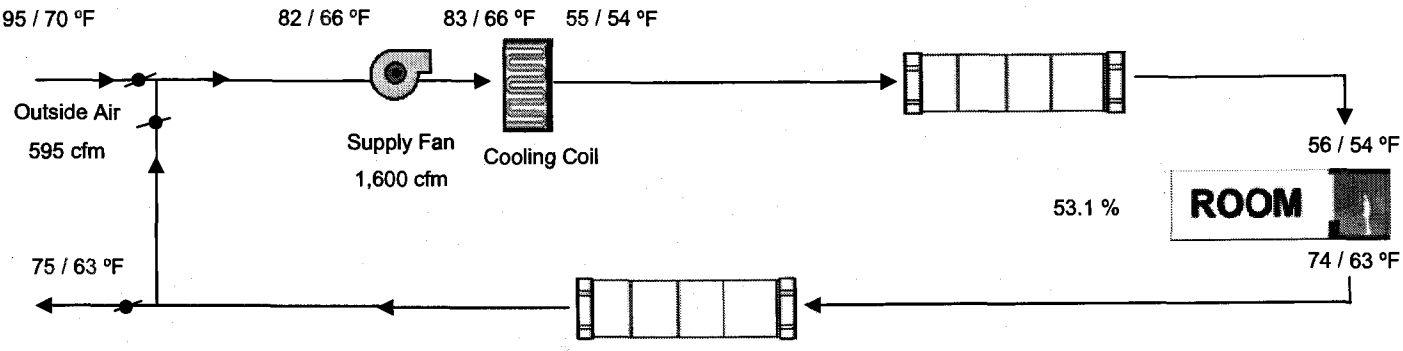
HVAC EQUIPMENT SELECTION

Trane YHC-048	45,956	2,621		48,000
Total Adjusted System Output (Adjusted for Peak Design conditions)	45,956	2,621		48,000
TIME OF SYSTEM PEAK		Jul 3 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
CU/ACC-D-1	236

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	16,000
Total Output (Btuh)	16,000
Output (Btuh/sqft)	67.8
Cooling System	
Output per System	12,000
Total Output (Btuh)	12,000
Total Output (Tons)	1.0
Total Output (Btuh/sqft)	50.8
Total Output (sqft/Ton)	236.0
Air System	
CFM per System	430
Airflow (cfm)	430
Airflow (cfm/sqft)	1.82
Airflow (cfm/Ton)	430.0
Outside Air (%)	7.0 %
Outside Air (cfm/sqft)	0.13

Note: values above given at ARI conditions

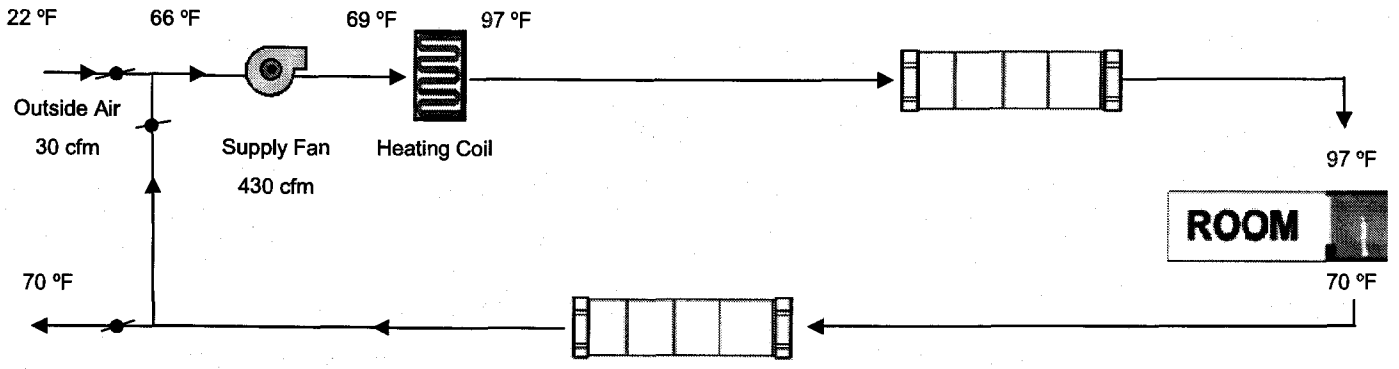
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	172	3,397	412	117	3,303
Return Vented Lighting		0			
Return Air Ducts		170			165
Return Fan		0			0
Ventilation	30	623	206	30	1,516
Supply Fan		1,312			-1,312
Supply Air Ducts		170			165
TOTAL SYSTEM LOAD		5,672	618		3,837

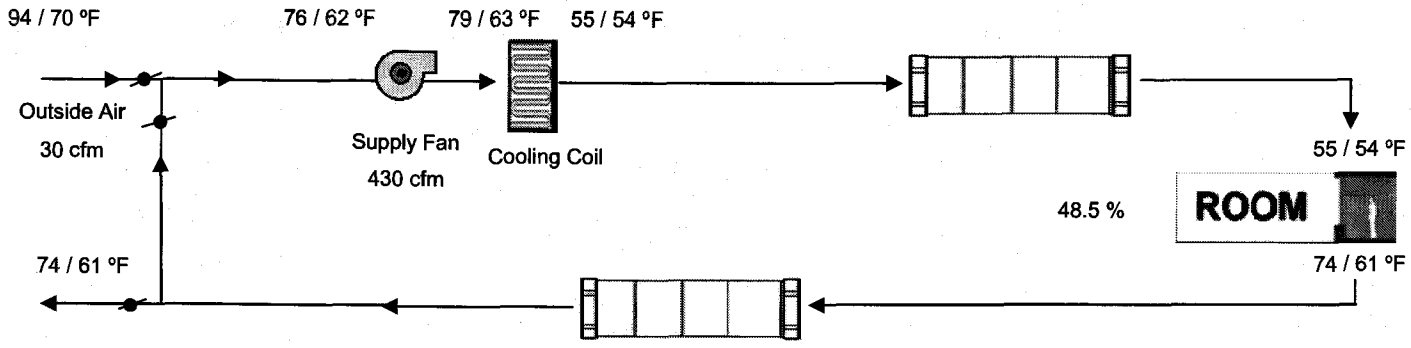
HVAC EQUIPMENT SELECTION

12RLS/AOU112RLS		10,796	536	8,919
Total Adjusted System Output (Adjusted for Peak Design conditions)		10,796	536	8,919
TIME OF SYSTEM PEAK		Jul 4 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
CU/ACC-D-3	213

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	16,000
Total Output (Btuh)	16,000
Output (Btuh/sqft)	75.1
Cooling System	
Output per System	12,000
Total Output (Btuh)	12,000
Total Output (Tons)	1.0
Total Output (Btuh/sqft)	56.3
Total Output (sqft/Ton)	213.0
Air System	
CFM per System	430
Airflow (cfm)	430
Airflow (cfm/sqft)	2.02
Airflow (cfm/Ton)	430.0
Outside Air (%)	7.4 %
Outside Air (cfm/sqft)	0.15

Note: values above given at ARI conditions

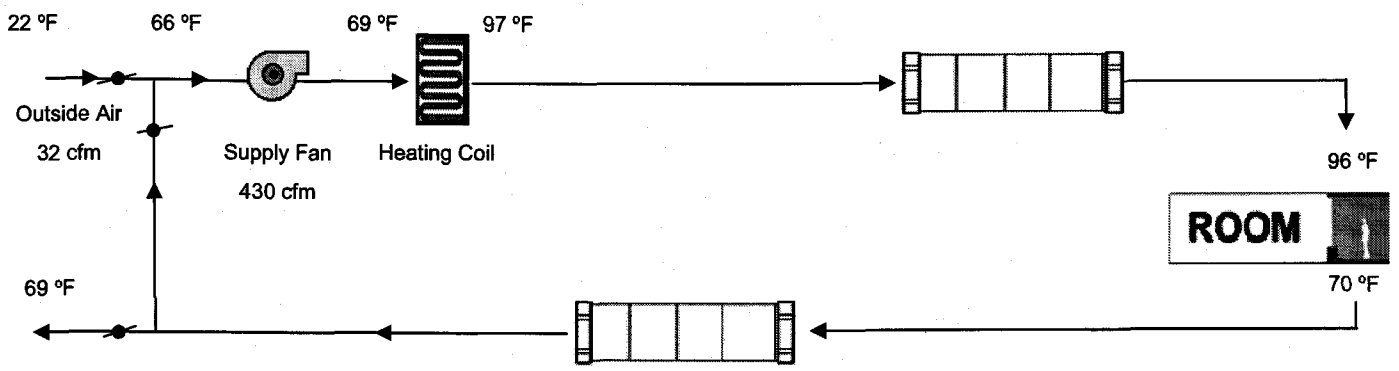
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	256	5,003	439	174	4,882
Return Vented Lighting		0			
Return Air Ducts		250			244
Return Fan		0			0
Ventilation	32	693	218	32	1,609
Supply Fan		1,312			-1,312
Supply Air Ducts		250			244
TOTAL SYSTEM LOAD		7,508	657		5,666

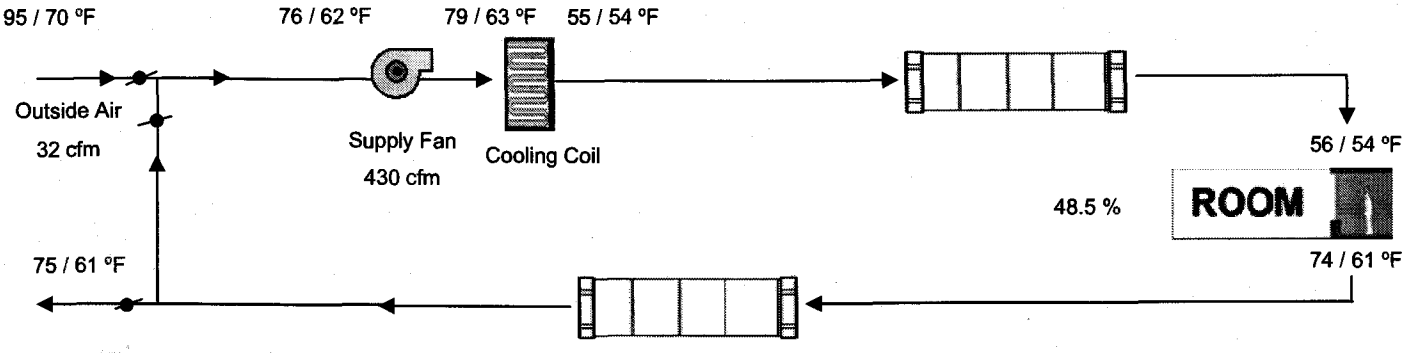
HVAC EQUIPMENT SELECTION

12RLS/AOU112RLS		10,851	442	8,919
Total Adjusted System Output (Adjusted for Peak Design conditions)		10,851	442	8,919
TIME OF SYSTEM PEAK		Jul 3 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



HVAC SYSTEM HEATING AND COOLING LOADS SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
CU/ACC-D-4	236

ENGINEERING CHECKS

Number of Systems	1
Heating System	
Output per System	16,000
Total Output (Btuh)	16,000
Output (Btuh/sqft)	67.8
Cooling System	
Output per System	12,000
Total Output (Btuh)	12,000
Total Output (Tons)	1.0
Total Output (Btuh/sqft)	50.8
Total Output (sqft/Ton)	236.0
Air System	
CFM per System	430
Airflow (cfm)	430
Airflow (cfm/sqft)	1.82
Airflow (cfm/Ton)	430.0
Outside Air (%)	8.2 %
Outside Air (cfm/sqft)	0.15

Note: values above given at ARI conditions

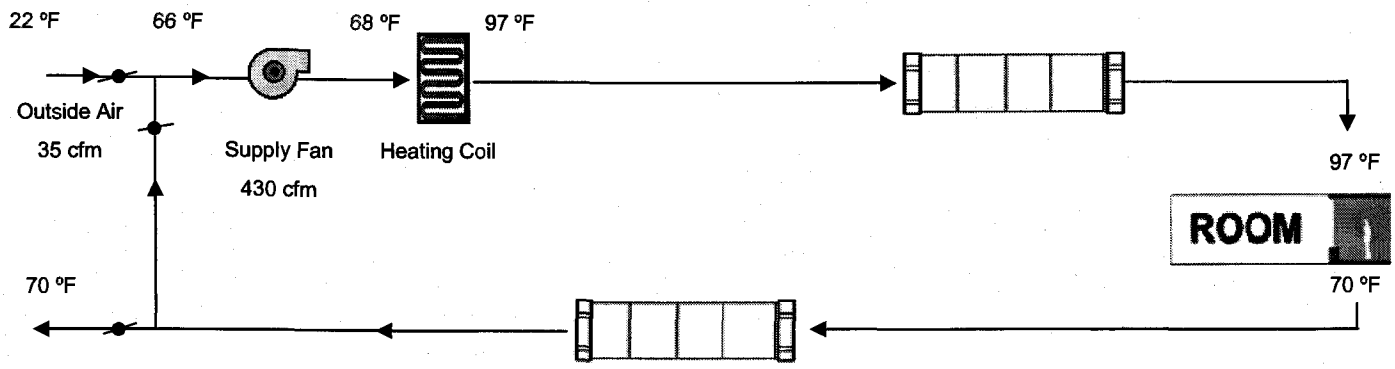
SYSTEM LOAD

	COIL COOLING PEAK			COIL HTG. PEAK	
	CFM	Sensible	Latent	CFM	Sensible
Total Room Loads	205	4,038	486	157	4,428
Return Vented Lighting		0			
Return Air Ducts		202			221
Return Fan		0			0
Ventilation	35	772	238	35	1,784
Supply Fan		1,312			-1,312
Supply Air Ducts		202			221
TOTAL SYSTEM LOAD		6,526	724		5,343

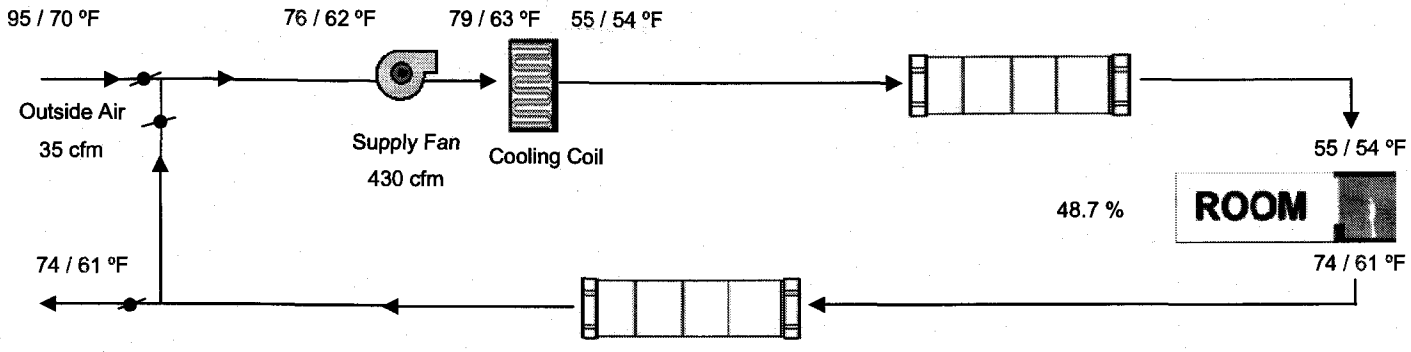
HVAC EQUIPMENT SELECTION

12RLS/AOU112RLS		10,846	461	8,919
Total Adjusted System Output (Adjusted for Peak Design conditions)		10,846	461	8,919
TIME OF SYSTEM PEAK		Aug 3 PM		Jan 1 AM

HEATING SYSTEM PSYCHROMETRICS (Airstream Temperatures at Time of Heating Peak)



COOLING SYSTEM PSYCHROMETICS (Airstream Temperatures at Time of Cooling Peak)



ZONE LOAD SUMMARY

Project Name: *HCC Bldg. D*
Date: *10/27/2011*
System Name: *AC-D-4*
Floor Area: *1,154*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone -4		*1.0*					*595*	*Jul 3 PM*	*1,088*	*30,026*	*11,471*	*82*	*36,379*
Zone- 4A		*1.0*					*0*	*Jul 2 PM*	*167*	*3,278*	*205*	*78*	*5,779*
			TOTALS	*0*	*0*	*0*	*595*	*Jul 3 PM*		*33,245*	*11,676*		*42,158*

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	*10/27/2011*
System Name	**Floor Area**
CU/ACC-D-2	*213*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone-7		*1.0*					*32*	*Jul 5 PM*	*189*	*4,322*	*619*	*119*	*4,993*
TOTALS			*0*	*0*	*0*	*32*		*Jul 5 PM*		*4,322*	*619*		*4,993*

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-5	1,270

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone-5		1.0					595	Jul 2 PM	1,092	16,764	8,171	82	6,085
Zone- 5A		1.0					53	Jul 5 PM	174	2,674	875	72	5,325
Zone -5B		1.0					47	Jul 3 PM	190	2,912	785	34	2,524
			TOTALS	0	0	0	695	Jul 3 PM		22,257	9,831		13,934

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-2	1,977

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone-2		1.0					323	Oct 2 PM	1,086	16,729	4,437	115	8,482
Zone -2A		1.0					47	Aug 2 PM	196	3,015	785	34	2,524
Zone- 2B		1.0					108	Jul 2 PM	392	6,031	1,800	92	6,815
		TOTALS		0	0	0	478	Jul 2 PM		25,426	7,022		17,821

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	10/27/2011
System Name	**Floor Area**
AC-D-1	1,074

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone-1		1.0					317	Aug 2 PM	1,113	17,198	4,347	120	8,878
Zone-1A		1.0					12	Aug 2 PM	58	889	168	18	1,320
			TOTALS	0	0	0	329	Aug 2 PM		18,086	4,515		10,197

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	*10/27/2011*
System Name	**Floor Area**
AC-D-3	*714*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone -3		*1.0*					*595*	*Jul 3 PM*	*1,108*	*34,835*	*11,471*	*552*	*45,823*
		TOTALS		*0*	*0*	*0*	*595*	*Jul 3 PM*		*34,835*	*11,471*		*45,823*

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	*10/27/2011*
System Name	**Floor Area**
CU/ACC-D-1	*236*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone 6		*1.0*					*30*	*Jul 4 PM*	*172*	*4,032*	*579*	*117*	*4,831*
		TOTALS		*0*	*0*	*0*	*30*	*Jul 4 PM*		*4,032*	*579*		*4,831*

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	*10/27/2011*
System Name	**Floor Area**
CU/ACC-D-3	*213*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone 8		*1.0*					*32*	*Jul 3 PM*	*256*	*5,714*	*616*	*174*	*6,508*
TOTALS				*0*	*0*	*0*	*32*	*Jul 3 PM*		*5,714*	*616*		*6,508*

(BLOCK LOAD)

ZONE LOAD SUMMARY

Project Name	Date
HCC Bldg. D	*10/27/2011*
System Name	Floor Area
CU/ACC-D-4	*236*

ZONE LOAD SUMMARY

		ZONAL SYSTEM						COOLING PEAK				HEATING PEAK	
ZONE NAME	SYSTEM NAME	Mult.	CFM	Sensible	Latent	Heating	OA CFM	Peak Hr	CFM	Sensible	Latent	CFM	Sensible
Zone 9		1.0					35	Aug 3 PM	205	4,827	682	157	6,231
	TOTALS			0	0	0	35	Aug 3 PM		4,827	682		6,231

(BLOCK LOAD)

SavingsByDesign — UTILITY INCENTIVE WORKSHEET — UTIL-1

Project Name	Date
HCC Bldg. D	*10/27/2011*

Step 1 ANNUAL TDV ENERGY USE (kBtu/sqft-yr)

ENERGY COMPONENT	Standard	Proposed	Margin
Space Heating	20.91	7.33	13.58
Space Cooling	108.22	64.00	44.22
Indoor Fans	60.04	66.88	-6.85
Heat Rejection	0.00	0.00	0.00
Pumps	0.00	0.00	0.00
Domestic Hot Water	24.28	17.70	6.58
Lighting	65.96	49.95	16.01
Receptacle	44.44	44.44	0.00
Process	0.00	0.00	0.00
Process Lighting	0.00	0.00	0.00
TOTALS:	323.85	250.31	73.54

Step 2 PERCENT BELOW TITLE 24

Adjusted TDV Energy Use
(Excludes Process Energy)

Standard Design		Proposed Design		Margin
323.85	-	250.31	=	73.54

Margin		Standard Design		% Below Title 24*
73.54	/	323.85	=	22.7 %

Incentive Eligibility — Yes ☑ No ☐
Owner Incentive (>=10%)

Conditioned Floor Area = 7,087.0 ft² sq. ft.

Step 3 ANNUAL SITE ENERGY USE

Average 2pm - 5pm Peak Demand (kW)	Standard	Proposed	Margin
	41.7	30.8	10.9

The values shown here are based upon the results of an EnergyPro Compliance energy analysis that uses Title 24 profiles as specified in the Alternative Calculation Method manual.

ENERGY COMPONENT	Standard		Proposed		Margin	
	Electricity (kWh)	Natural Gas (therms)	Electricity (kWh)	Natural Gas (therms)	Electricity (kWh)	Natural Gas (therms)
Space Heating	628	797	110	289	518	508
Space Cooling	26,201	0	14,275	0	11,926	0
Indoor Fans	21,317	0	23,747	0	-2,430	0
Heat Rejection	0	0	0	0	0	0
Pumps	0	0	0	0	0	0
Domestic Hot Water	0	1,054	0	769	0	286
Lighting	22,947	0	17,378	0	5,569	0
Receptacle	16,260	0	16,260	0	0	0
Process	0	0	0	0	0	0
Process Lighting	0	0	0	0	0	0
TOTALS:	87,352	1,851	71,770	1,058	15,582	794

Step 4 POTENTIAL OWNER INCENTIVE CALCULATION

	% Below Title-24* (from step 2)		Incentive Rate		Savings (from Step 3)		Subtotal
Electricity (kWh)	22.7 %	→	22.7 ¢/kWh	x	15,582 kWh	=	$3,537
Electricity (kW)		=	100.00 $/kW	x	10.9 kW	=	$1,090
Natural Gas		=	100.0 ¢/therm	x	794 therm	=	$794

Pacific Gas and Electric Company

Owner Incentive → **($500,000 max) =** $5,421

Potential incentives indicated on this report are available only through the Whole Building Approach Element of the Savings By Design Program for new construction and are NOT GUARANTEED. Projects MUST receive prior, written approval from The Utility during conceptual or early design development and must meet all other program requirements to qualify. Potential incentives are subject to program limitations based upon the incremental cost of the measures.

*% Below in this equation is limited to 30%.

Savings By Design — UTILITY INCENTIVE WORKSHEET — UTIL-DT

Project Name	Date
HCC Bldg. D	10/27/2011

Step 1 ANNUAL TDV ENERGY USE (kBtu/sqft-yr)

ENERGY COMPONENT	Standard	Proposed	Margin
Space Heating	20.91	7.33	13.58
Space Cooling	108.22	64.00	44.22
Indoor Fans	60.04	66.88	-6.85
Heat Rejection	0.00	0.00	0.00
Pumps	0.00	0.00	0.00
Domestic Hot Water	24.28	17.70	6.58
Lighting	65.96	49.95	16.01
Receptacle	44.44	44.44	0.00
Process	0.00	0.00	0.00
Process Lighting	0.00	0.00	0.00
TOTALS:	323.85	250.31	73.54

Step 2 PERCENT BELOW TITLE 24

Adjusted TDV Energy Use
(Excludes Process Energy)

Standard Design		Proposed Design		Margin
323.85	-	250.31	=	73.54

Margin		Standard Design		% Below Title 24*
73.54	/	323.85	=	22.7 %

Incentive Eligibility — Yes ☑ No ☐
Design Team Incentive (>=10%)

Conditioned Floor Area = 7,087 **sq. ft.**

Step 3 ANNUAL SITE ENERGY USE

	Standard	Proposed	Margin
Average 2pm - 5pm Peak Demand (kW)	41.7	30.8	10.9

The values shown here are based upon the results of an EnergyPro Compliance energy analysis that uses Title 24 profiles as specified in the Alternative Calculation Method manual.

ENERGY COMPONENT	Standard		Proposed		Margin	
	Electricity (kWh)	Natural Gas (therms)	Electricity (kWh)	Natural Gas (therms)	Electricity (kWh)	Natural Gas (therms)
Space Heating	628	797	110	289	518	508
Space Cooling	26,201	0	14,275	0	11,926	0
Indoor Fans	21,317	0	23,747	0	-2,430	0
Heat Rejection	0	0	0	0	0	0
Pumps	0	0	0	0	0	0
Domestic Hot Water	0	1,054	0	769	0	286
Lighting	22,947	0	17,378	0	5,569	0
Receptacle	16,260	0	16,260	0	0	0
Process	0	0	0	0	0	0
Process Lighting	0	0	0	0	0	0
TOTALS:	87,352	1,851	71,770	1,058	15,582	794

Step 4 POTENTIAL DESIGN TEAM INCENTIVE CALCULATION

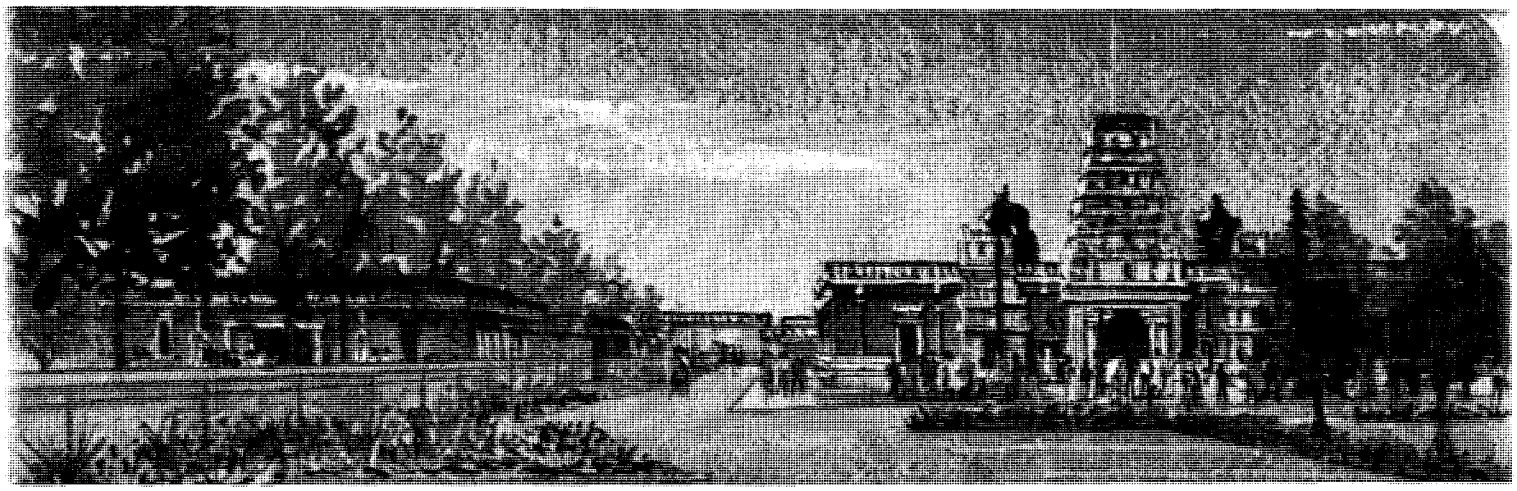
	% Below Title-24* (from step 2)		Incentive Rate		Savings (from Step 3)		Subtotal
Electricity (kWh)	(22.7 % / 3)	→	7.6 ¢/kWh	x	15,582 kWh	=	$1,184
Electricity (kW)		=	33.33 $/kW	x	10.9 kW	=	$363
Natural Gas		=	33.3 ¢/therm	x	794 therm	=	$264

Design Team Incentive → **($50,000 max) =** $1,811

Potential incentives indicated on this report are available only through the Whole Building Approach-Design Team element of the Savings By Design Program for new construction and are NOT GUARANTEED. Projects MUST receive prior, written approval from The Utility during conceptual or early design development and must meet all other program requirements to qualify. Potential incentives are subject to program limitations based upon the incremental cost of the measures.

*% Below in this equation is limited to 30%.

Specifications For Civil Work Building D



HINDU COMMUNITY AND CULTURAL CENTER
SPECIFICATIONS FOR CIVIL WORK

The portions of the City of Livermore Standard Specifications, which are pertinent to the civil drawings, are as follows:

Division 1 – General Requirements for Developments

Section 011100 – Summary of Work
Section 013100 – Coordination
Section 013300 – Submittals
Section 014200 – Reference Standards
Section 014213 – Abbreviations
Section 014500 – Quality Control
Section 015100 – Temporary Utilities
Section 015500 – Site Access and Storage
Section 015526 – Temporary Traffic Control Systems
Section 015600 – Protection of Existing Facilities
Section 015700 – Site Preparation
Section 015713 – Temporary Erosion Control
Section 015719 – Temporary Environmental Controls
Section 016600 – Materials and Equipment
Section 017123 – Field Engineering
Section 017700 – Project Closeout

Division 2 – Existing Condition

Section 022100 – Monuments
Section 024100 – Demolition

Division 3 – Concrete

Section 033500 – Textured Concrete Paving
Section 034800 – Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets
Section 036000 – Grout

Division 5 – Metals

Section 055900 – Ductile Iron Pipe

Division 31 – Earthwork

Section 310000 – Earthwork
Section 311300 – Selective Tree and Vegetation Trimming and Removal
Section 311316 – Root Pruning
Section 312300 – Utility Earthwork
Section 312323 – Controlled Low Strength Materials (CLSM)

Division 32 – Exterior Improvements

Section 321000 – Asphalt Pavement, Base, and Surface Treatments
Section 321200 – Selective Tree and Vegetation Trimming and Removal
Section 321300 – Concrete Surface Improvements
Section 321723 – Traffic Stripes and Pavement Markings
Section 323113 – Chain Link Fences and Gates

Division 33 – Utilities

Section 330130 – Sanitary Sewer and Storm Drain System Leakage Testing
Section 330526 – Piping Identification Systems
Section 331100 – Piping General
Section 331102 – PVC Pressure Pipe
Section 331200 – Miscellaneous Piping, Valves, Fittings, and Appurtenances
Section 331213 – Backflow Prevention Assemblies and Pressure Reducing Valves
Section 331215 – Valves, General
Section 331216 – Gate Valves
Section 331217 – Butterfly Valves
Section 331218 – Check Valves
Section 331219 – Fire Hydrants
Section 331233 – Water Meters
Section 331300 – Pressure Pipeline Testing and Disinfection
Section 333102 – ABS and PVC Composite Pipe
Section 333104 – Small ABS and PVC Non-Pressure Pipe
Section 333106 – Vitrified Clay Pipe
Section 333900 – Precast Concrete Maintenance Holes
Section 334100 – Corrugated Polyethylene Nonpressure Pipe (HDPE)
Section 334102 – Reinforced Concrete Pipe

Division 34 – Transportation

Section 344105 – Signage

CITY OF LIVERMORE

TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS FOR DEVELOPMENTS

SECTION 011100

SUMMARY OF WORK

1.01 ORDER OF THE WORK

A. In order to expedite the work and to avoid irreparable damage to, or deterioration of the quality of any portion of the public works improvements, it shall be the responsibility of the DEVELOPER to schedule the major items of construction in the following order:

1. Street excavation and rough grading
2. Storm and sanitary sewers
3. Water facilities, and their services
4. Underground gas, electric, telephone, cable TV
5. Curb, gutter, sidewalk, driveways, and access ramps
6. Street sub-base (if required)
7. Base rock
8. Paving

1.02 NOTIFICATIONS

A. For all developments the DEVELOPER shall notify owners of adjacent property and affected utilities when prosecution of the work may affect them. Said notification shall consist of erection of a sign at the main construction site entrance and notices to the adjacent property owners. Guidelines on who to notify, and a sample of approved notification form are available from the Development Section. The sign and notices shall include the name, address, and (local) phone number of the DEVELOPER.

B. When work is required in any existing street, the CONTRACTOR shall notify all residents 72 hours in advance of all operations. When parked vehicles interfere with the CONTRACTOR'S operations, the CONTRACTOR shall post temporary "NO PARKING" signs maximum 100 feet apart on each side of the street 72 hours prior to the scheduled work day. "No parking" signs shall include the following information: Time(s), day(s), date(s), purpose and the following statement: "Violators will be towed at owner's expense. CVC 22651. For information on towed vehicles phone: 371-4900."

C. If the work has not commenced during this period, the work shall be rescheduled with five (5) working days advance notice. If the work is not completed by the end of the period covered in the initial notification of the CONTRACTOR shall re-notify all residents of the construction schedule extension. The CONTRACTOR will perform all re-posting of no parking signs and re-notification occasioned by his failure to meet the posted schedule.

1.03 PRE-CONSTRUCTION MEETING

A. Except for work covered by an Encroachment Permit, a pre-construction meeting is required prior to commencement of any work. The meeting will be held at a mutually agreed time and place which shall be attended by the CITY, the DEVELOPER/DEVELOPERS' ENGINEER or Representative, CONTRACTOR'S Construction Superintendent, Subcontractors (as appropriate), and other governmental or agency representatives as appropriate.

B. The CONTRACTOR shall bring to the preconstruction meeting 6 copies of each of the following:

1. Tentative construction schedule

2. Shop drawing/sample/substitute or "or equal" submittal schedule

C. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.

1.04 MAINTAINING TRAFFIC IN PUBLIC STREETS

A. The CONTRACTOR'S attention is directed to Sections 7-1.08, 7-1.09, and Section 12 of the CalTrans Standard Specifications. Nothing in these Contract Documents shall be construed as relieving the CONTRACTOR from his responsibility to comply with Sections 7-1.08, 7-1.09 and Section 12 of the Caltrans Standard Specifications.

B. The CONTRACTOR shall be responsible for providing all flagmen and traffic control in conformance with the current edition of the Caltrans Traffic Manual, and the "Uniform Sign Chart," issued by the Department of Public Works, Division of Highways, and shall furnish, erect, maintain, and remove all necessary signs and devices during the length of the construction. Modifications to the approved traffic control plan, dictated by the field traffic conditions, shall be made immediately by the CONTRACTOR as required by the ENGINEER.

C. Personal vehicles of the CONTRACTOR'S employees shall not be parked on the traveled way or shoulders within any section closed to the public traffic.

D. A minimum of one paved traffic lane, not less than 12 feet wide shall be open for use by public traffic in each direction of travel, except that single paved 12 foot wide traffic lane may be used with flagmen for short lengths and short periods of time when specifically allowed by the ENGINEER.

E. The full width of the traveled way shall be open for use by public traffic as follows unless otherwise approved by the Engineer:

1. On all designated major streets before 9:00 am and after 3:30 pm, Monday through Friday;

2. On all other streets before 7:00 am and after 5:00 pm, Monday through Friday;

3. On all streets regardless of designation all day on Saturday, Sunday, and designated legal holidays; and after 3:30 pm on the day preceding a City designated legal holiday.

END OF SECTION

SECTION 013100

COORDINATION

1.01 GENERAL

A. The CONTRACTOR shall be responsible for the coordination of all work and the coordination of the work of all subcontractors. The CONTRACTOR shall not delegate coordination to any subcontractor. Coordination, as referred to herein, shall include the establishment of on-site lines of authority and communication. The CONTRACTOR'S onsite supervisory person shall be present at all times when any work is in progress.

1.02 SCHEDULING

A. The CONTRACTOR shall prepare construction schedules as specified in Section 013300 "Submittals", and all schedule submittals shall conform to the requirements specified therein.

1.03 REQUESTS FOR SUBSTITUTIONS

A. The CONTRACTOR shall review subcontractor's requests for changes and for substitutions.

B. All requests or substitutions shall conform to the requirements of Section 013300 "Submittals".

1.04 SUBMITTALS

A. All submittals to the CITY shall be made by the DEVELOPER.

1.05 COORDINATION OF SUBCONTRACTOR RESPONSIBILITIES

A. The CONTRACTOR shall be responsible for coordination of the work of each of its subcontractors and suppliers. Special attention is directed to the following obligations of the CONTRACTOR:

1. Verify that subcontractors have obtained permits for inspections.

2. Review all subcontractor shop drawings, product data, and sample submittals for compliance prior to submittal to CITY for review.

3. Maintain onsite documentation and keep current record drawing set at the construction site.

END OF SECTION

SECTION 013300

SUBMITTALS

1.01 GENERAL

A. General: Whenever submittals are required hereunder, all such submittals shall be submitted to the ENGINEER for review. A Submittal is defined as any drawing, calculation, specification, product data, samples, manuals, requests for substitutes, survey data, record drawings, or similar items.

B. Submittals Required at the Preconstruction Meeting: At the preconstruction meeting, the CONTRACTOR shall submit the following items:

1. A schedule of work, which shall be based on the following order of work:

   a. Rough Grading
   b. Sanitary Sewer
   c. Storm Drainage
   d. Water Mains
   e. Joint Trench
   f. Subgrade
   g. Aggregate Subbase
   h. Concrete Surface Improvements
   I. Aggregate Base
   j. Asphalt Concrete Pavement
   k. Striping, Markings
   l. Signs
   m. Monuments
   n. Fire Hydrants
   o. Street Lights
   p. Landscaping

2. A preliminary schedule of shop drawings, samples, and proposed substitutes or "or equal" submittals.

3. A list of all permits the DEVELOPER or DEVELOPER'S CONTRACTOR is required to obtain.

C. Submittals Required After the Preconstruction Meeting: The DEVELOPER'S CONTRACTOR shall submit to the ENGINEER all proposed substitutes or "or equal" products thirty (30) days prior to use on the work, for review. All such submittals shall be in conformance with the requirements of Paragraphs 1.03 and 1.04 herein.

1. The DEVELOPER shall submit copies of all required permits prior to starting any work covered by the various permits.

2. The CONTRACTOR hereby agrees that failure to submit alternative product requests within the stipulated time period shall act as a waiver of any future rights to offer such substitutes, and the CONTRACTOR hereby agrees to provide one of the specified products called for on the DRAWINGS.

3. The DEVELOPER shall also submit a copy of the valid trench shoring permit issued by CAL OSHA, if applicable, prior to starting any trenching.

D. All submittals shall be accompanied by a standard transmittal form or cover letter acceptable to the ENGINEER. Information shall include, but not be limited to, DEVELOPER'S name and address,

project identification, sender's name and phone number, and a summary of the purpose of the transmittal.

1.02 CERTIFICATES OF COMPLIANCE

A. **Certificates of Compliance**: The CONTRACTOR shall provide Certificates of Compliance for all products and materials proposed to be used. The Certificates of Compliance shall include identification of the material, material source, name of the supplier, project name, and the segment of the WORK where the material represented by the sample is to be used.

1.03 SHOP DRAWINGS

A. Whenever called for in the DRAWINGS, or where required by the ENGINEER, the CONTRACTOR shall furnish to the ENGINEER for review, a minimum of six (6) copies of each shop drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instruction, catalog sheets, data sheets, and similar items. Unless otherwise required, said Shop DRAWINGS shall be submitted to the ENGINEER at a time sufficiently early to allow review of same by the ENGINEER, and to accommodate the anticipated rate of construction progress.

B. All Shop Drawings shall be accompanied by a standard transmittal form or cover letter approved by the ENGINEER. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, will not be considered. Incomplete submittals will be returned for resubmittal only if the sender is identified on the form or cover letter.

C. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the ENGINEER.

D. Except as may otherwise be provided herein, the ENGINEER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 21 calendar days following their receipt by the ENGINEER. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item. Anything after the initial submittal and first re-submittal for review is defined as EXCESSIVE REVIEW and all costs for EXCESSIVE REVIEW shall be charged to the DEVELOPER. Final acceptance will be withheld until all costs for EXCESSIVE REVIEW are reimbursed to the CITY.

E. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission of said submittal will NOT be required.

F. If a submittal is returned to the CONTRACTOR marked "MAKE CORRECTIONS NOTED," a formal revision and resubmission of said submittal will NOT be required.

G. If a submittal is returned to the CONTRACTOR marked "AMEND - RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit a minimum of 6 copies of said revised submittal to the ENGINEER.

H. If a submittal is returned to the CONTRACTOR marked "REJECTED-RESUBMIT," the CONTRACTOR shall revise said submittal and shall resubmit a minimum of 6 copies of said revised submittal to ENGINEER.

I. Fabrication of an item may be commenced only after the ENGINEER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents.

J. All CONTRACTOR submittals shall be carefully reviewed by the DEVELOPER'S ENGINEER, prior to submittal to the ENGINEER. Each submittal shall be dated, signed, and certified by the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated, signed, and certified. No consideration for review by the ENGINEER of any CONTRACTOR submittals will be made for any items which have not been so certified by the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR. All non-certified submittals will be returned to the DEVELOPER'S ENGINEER and DEVELOPER'S CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

K. The ENGINEER's review of CONTRACTOR submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.04 PROPOSED SUBSTITUTES OR "OR EQUAL" ITEMS

A. For convenience in designation, any material, product, or equipment to be incorporated may be designated under a brand or trade name or the name of a manufacturer and its catalog information. The use of any substitute material, product, or equipment which is equal in quality and utility and possesses the required characteristics for the purpose intended will be permitted, subject to the following requirements:

1. The burden of proof as to the quality and utility of any such substitute material, product, or equipment shall be upon the CONTRACTOR.

2. The ENGINEER will be the sole judge as to the quality and utility of any such substitute material, product, or equipment and its decision shall be final.

B. Whenever the name or the name and address of a manufacturer or Supplier is given for a material, product, or equipment, or if any other source of a material, product, or equipment is indicated therefore, such information is given for the convenience of the CONTRACTOR only, and no limit, restriction, or direction is indicated or intended thereby, nor is the accuracy or reliability of such information guaranteed. It shall be the responsibility of the CONTRACTOR to determine the accurate identity and location of any such manufacturer, Supplier, or other source of any material, product, or equipment called for.

C. The CONTRACTOR may offer any material, product, or equipment which it considers equal to those specified. The CONTRACTOR, at its sole expense, shall furnish data concerning items it has offered as substitute or "or-equal" to those specified. The CONTRACTOR shall provide the data required by the ENGINEER to determine that the quality, strength, physical, chemical, or other characteristics, including durability, finish, efficiency, dimensions, service, and suitability are such that the substitute or "or-equal" item will fulfill its intended function.

D. Approval by the ENGINEER of a substitute item proposed by the CONTRACTOR shall not relieve CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substituted item. The CONTRACTOR shall also be responsible for resultant changes and all additional costs which the substitution requires in its work, the work of its subcontractors and of other contractors and shall effect such changes without cost to CITY.

1.05 SAMPLES

A. Unless otherwise specified, whenever samples are required, the CONTRACTOR shall submit not less than 3 units of each such sample item or material to the ENGINEER for approval at no cost to the CITY.

B. Samples, as required herein, shall be submitted for approval a minimum of 14 calendar days prior to ordering such material for delivery to the job-site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled for review by the ENGINEER.

C. All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and manufacturer's names for identification and submitted to the ENGINEER for review for compliance. Upon receiving approval of the ENGINEER, two sets of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set will be retained by the ENGINEER.

D. Unless otherwise specified, all colors and textures of specified items will be selected from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.06 ACCEPTANCE FOR MAINTENANCE

A. Improvements will not be accepted by the CITY for permanent maintenance until the CONTRACTOR-prepared sepialar Record DRAWINGS have been delivered to the ENGINEER.

1.07 USE OF PRIVATE PROPERTY

A. If the CONTRACTOR uses private property for access or construction the CONTRACTOR shall obtain all necessary permits/approvals from the Planning Department and submit to the ENGINEER a copy of each agreement executed with the private property owner(s) for access or use of the private property prior to using said private property.

1.08 PIPELINE CUT SHEETS

A. The CONTRACTOR shall submit to the ENGINEER cut sheets for any sanitary sewer line installation, storm drain line installation, and curb and gutter construction, 24 hours prior to start of construction work.

1.09 STREET LIGHT WIRING PLAN

A. The CONTRACTOR shall submit an acceptable street light wiring plan, indicating the wiring run, and the location of the power source, for review by the ENGINEER prior to starting installation of any street lights.

1.10 STREET TREE REMOVAL

A. The CONTRACTOR shall give the ENGINEER 10 calendar days notice prior to removal of any street tree designated for removal on the Approved Construction DRAWINGS. Whenever it is determined by the CITY that a street tree must be removed, the ENGINEER must post the tree under the provisions of Chapter 12.20 of the Livermore Municipal Code.

1.11 GRADING

A. The DEVELOPER shall notify the ENGINEER 2 working days prior to starting ANY grading on the site.

END OF SECTION

SECTION 014200

REFERENCE STANDARDS

1.01 GENERAL

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever in these specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date of CITY approval of the Construction Drawings or issuance of an Encroachment Permit, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the general provisions of other portions of the specifications, all work specified herein shall conform to or exceed the requirements of all applicable codes and the applicable requirements of the following documents to the extent that the provisions of such documents are not in conflict with the requirements of these Specifications nor the applicable codes.

B. References herein to codes shall mean the following listed codes, the editions as adopted by the City of Livermore, including all addenda, modifications, amendments, or other lawful changes thereto:

1. Uniform Building Code, published by the International Conference of Building Officials (ICBO).
2. Uniform Plumbing Code, published by the International Association of Plumbing and Mechanical Officials (IAPMO).
3. Uniform Mechanical Code, published by the International Conference of Building Officials (ICBO).
4. National Electric Code, published by the National Fire Protection Association (NFPA).
5. Uniform Fire Code, published by the International Conference of Building Officials (ICBO).
6. California Code of Regulations; Title 8 Industrial Relations, Title 19 Public Safety, Title 24 Building Standards, and California Labor Code.
7. Livermore Municipal Code
8. Livermore Zoning Ordinance.

C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor.

D. References herein or on the Drawings to "State Standard Specifications" or "Standard Specifications" shall mean the Standard Specifications current metric edition as adopted by the State of California, Department of Transportation ("Caltrans").

E. References herein or on the Drawings to "Livermore Standard Specifications" or "CITY Standard Specifications" shall mean the City of Livermore Standard Specifications, current edition or as specified on the Approved Construction Drawings.

F. References herein or on the Drawings to "State Standard Plans" or "Standard Plans" shall mean the Standard Plans, current metric edition as adopted by the State of California, Department of Transportation ("Caltrans").

G. References herein or on the Drawings to "Livermore Standard Details", "CITY Standard Details" or "Standard Details" shall mean the City of Livermore, Standard Details, current edition or as specified on the Approved Construction Drawings.

H. References herein or on the Drawings to "Cal-OSHA" shall mean State of California, Department of Industrial Relations, General Industry, Electrical and Construction Safety Orders, as amended to Date, and all changes and amendments thereto which are effective as of the date of construction.

I. References herein or on the Drawings to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

END OF SECTION

SECTION 014213

ABBREVIATIONS

1.01 GENERAL

A. Whenever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these specifications, the following acronyms or abbreviations which may appear in these specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS AND ACRONYMS

AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association., Inc.
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturer's Association
AHAM	Association of Home Appliance Manufacturer's
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASA	Acoustical Society of America
ASAE	American Society of Agriculture Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CALOSHA	California Occupational Safety and Health Administration
CALTRANS	State of California Department of Transportation
CBM	Certified Ballast Manufacturer's
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLPCA	California Lathing & Plastering Contractors Assn
CLFMI	Chain Link Fence Manufacturer's Institute

CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DCDMA	Diamond Core Drill Manufacturer's Association
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission of Association
MTI	Marine Testing Institute
NAAM	National Assn of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NGLI	National Lubricating Grease Institute
NMA	National Microfilm Association
NWMA	National Woodwork Manufacturer's Association
OSHA	Occupational Safety and Health Administration (Federal)
PCA	Portland Cement Association
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Maker Association
SIS	Swedish Standards Association
SMA	Screen Manufacturer's Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPR	Simplified Practice Recommendation
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Steel Structures Painting Council
SSPWC	Standard Specifications for Public Works Construction
TAPPI	Technical Assn of the Pulp and Paper Industry
TFI	The Fertilizer Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
USA	Underground Service Alert
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WIC	Woodwork Institute of California
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

END OF SECTION

SECTION 014500

QUALITY CONTROL

1.01 SITE INVESTIGATION AND CONTROL

A. The CONTRACTOR shall verify all dimensions in the field and shall check all field conditions continuously during construction. The CONTRACTOR shall be solely responsible for any inaccuracies built into the WORK.

B. The CONTRACTOR shall inspect related and appurtenant work and shall report in writing to the ENGINEER, any conditions which will prevent proper completion of the WORK. Any work required due to unsuitable conditions shall be done by the CONTRACTOR at its sole cost and expense.

1.02 INSPECTION OF THE WORK

A. General: The WORK shall be conducted under the general observation of the ENGINEER and shall be subject to inspection by the ENGINEER to assure strict compliance with the requirements of the Contract Documents.

B. The presence of the ENGINEER, or its representative, shall not relieve the CONTRACTOR of the responsibility for the proper execution of the WORK in accordance with all requirements of the Contract Documents. Compliance is distinctly a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of the ENGINEER.

C. All materials and articles furnished by the CONTRACTOR shall be subject to rigid inspection, and no material or articles shall be used until it has been inspected and reviewed for compliance by the ENGINEER.

D. Inspection at Place of Manufacture: Unless otherwise specified, all products, materials, and equipment shall be subject to inspection by the ENGINEER at the place of manufacture.

E. The presence of the ENGINEER at the place of manufacture however, shall not relieve the CONTRACTOR of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents.

F. At all times during construction, the CONTRACTOR shall prevent the formation of any airborne dust nuisance. If the CONTRACTOR fails to comply within 2 hours of notification, the CITY will issue a "STOP WORK ORDER".

1.03 SAMPLING AND TESTING

A. Sampling and testing for quality control is the sole responsibility of the CONTRACTOR. The CITY reserves the right to reject any products or materials found to be in non-compliance under quality assurance.

B. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM or other specified published standards, as applicable to the class and nature of the article or materials considered.

C. Any waiver by the CITY of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a "performance bond" to assure execution of any

necessary corrective or remedial WORK, shall not be construed as a waiver of any prescriptive or performance requirements of the Contract Documents. A "performance bond" as used herein is a separate bond in addition to the Performance Bond required in the Subdivision Agreement.

D. Notwithstanding the existence of such waiver, and in addition to any testing and inspection performed by any other inspector on behalf of the CITY or any other public agency having jurisdiction, the ENGINEER shall have the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the ENGINEER to require the removal or correction and reconstruction of any such work in accordance with the General Conditions for Development.

1.04 TIME OF INSPECTIONS AND TESTS

A. Required samples and test specimens shall be furnished by the CONTRACTOR and prepared for testing in ample time for the completion of the necessary tests and analyses before the subject materials or articles are to be used. The CONTRACTOR shall furnish all required test specimens at its own expense. Except as otherwise provided performance of the required initial test and first test will be by the CITY, and all costs therefor will be borne by the CITY; except, that the cost of any test after the first re-test, which shows unsatisfactory results shall be borne by the CONTRACTOR.

B. Whenever the CONTRACTOR is ready to backfill, bury, cast in concrete, or otherwise cover or make inaccessible any work, the CONTRACTOR shall notify the ENGINEER not less than 24 hours in advance of beginning any such work. Failure of the CONTRACTOR to notify the ENGINEER at least 24 hours in advance of any such inspections shall be reasonable cause for the CONTRACTOR's work to be delayed in order for inspections and any remedial or corrective work required, and all costs of such delays, including its impact or effect upon other portions of the WORK shall be borne by the CONTRACTOR.

END OF SECTION

SECTION 015100

TEMPORARY UTILITIES

1.01 CONSTRUCTION WATER

A. General: Construction water will be available and may be purchased from the City of Livermore, located at 1052 S. Livermore Ave., Livermore, CA 94550, or from the California Water Service Company, located at 195 South "N" Street, Livermore, CA 94550. The CONTRACTOR will also be required to apply for and furnish a deposit for use of the construction water meters. The CONTRACTOR shall provide all facilities necessary to convey the water from the designated source to the points of use in accordance with the requirements of the Contract Documents.

B. Reclaimed water may be used for dust abatement in accordance with Section 015719, "Temporary Environmental Controls". The CONTRACTOR shall contact the City of Livermore Water Resources Division for all permits required for use of reclaimed water.

C. The CONTRACTOR shall be solely responsible for the adequate functioning of its water supply system and shall be solely liable for any claims arising from the use of same, including discharge or waste of water therefrom.

D. Notices shall be posted conspicuously throughout the site warning the CONTRACTOR'S personnel that piped water may be contaminated.

E. Fire Hydrant Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant without first obtaining permission of the CITY or other authority having jurisdiction over the use of said fire hydrant and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant a valve and a construction meter, supplied by the CITY or said other authority and agency.

F. Pipeline Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any pipeline without first obtaining permission of the ENGINEER or California Water Service Company or other authority having jurisdiction over the use of said pipeline and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the pipeline a valve and a construction meter, supplied by the CITY or said other authority and agency.

G. Removal of Water Connections: Before final acceptance of the WORK on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of ENGINEER, the CITY, and/or other agency owning the affected utility.

END OF SECTION

SECTION 015500

SITE ACCESS AND STORAGE

1.01 MAINTAINING TRAFFIC

A. The CONTRACTOR shall be responsible for providing adequate traffic control in conformance with the requirements of the "Manual of Traffic Controls for Construction and Maintenance Work Zones," Current Edition, as Published by the State of California Department of Transportation.

B. Traffic Control: For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the "Manual of Traffic Controls for Construction and Maintenance Work Zones," Current Edition, published by the State of California, Department of Transportation and the Drawings, if applicable.

C. If closure of any street is necessary during construction, the CONTRACTOR shall submit a formal application and complete detour plan for a street closure to the CITY and/or other authority having jurisdiction at least 30 days prior to the needed street closure in order for the CITY and other agency having jurisdiction to review the application. The detour plan shall include all necessary signing and detour requirements, shall be signed and stamped by a registered professional engineer, and shall be a scaled design on 24" x 36" sheets.

1.02 HIGHWAY LIMITATIONS

A. All hauling by motor vehicles shall be confined to designated truck routes, except where otherwise authorized in writing by the ENGINEER.

1.03 CONTRACTOR'S WORK AND STORAGE AREA

A. The CONTRACTOR shall make its own arrangements for any necessary off-site storage areas necessary for the proper execution of the Work. Plans shall be submitted to the Planning Division for all proposed offsite storage areas in order to obtain any necessary permits. The CONTRACTOR shall obtain all necessary CITY permits for off-site storage and shall submit copies of the owner's written permission for such private property use.

B. The CONTRACTOR will not be allowed use of public street right-of-way or public land for work or storage areas without written approval of the ENGINEER.

1.04 TEMPORARY STREET USE

A. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alley, way, or parking area during the performance of the Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of the CITY, utility companies, or other agencies, or public access in such streets, alleys, ways, or parking areas. The CONTRACTOR shall be responsible for any damage to public facilities in the public right-of-way. Any damage done to these public facilities will be repaired and/or replaced by the CONTRACTOR.

B. No street shall be closed to the public without first obtaining the permission of the ENGINEER, the CITY, and other proper governmental authority, where applicable.

C. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times.

D. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, sewer inlets, and other drainage facilities.

E. Wherever necessary or required for the convenience of the public or individual residents or business places at street or highway crossings, private driveways, or elsewhere, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the ENGINEER prior to beginning the excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation.

F. Temporary bridges or steel plates for street and highway crossings shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

1.05 ACCESS SECURITY

A. Where construction site access is directly off of a public street the CONTRACTOR shall be responsible for providing and maintaining adequate fencing, barricades, and/or signs to prevent public access from the public street into the construction site 24-hours a day.

END OF SECTION

SECTION 015526

TEMPORARY TRAFFIC CONTROL SYSTEMS

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, place, and maintain all temporary traffic control systems, including construction and maintenance area traffic control devices and flaggers as required to perform the WORK in accordance with this Section, and all other appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Review of proposed WORK areas to determine temporary traffic control requirements.
2. Verification of temporary traffic controls with the ENGINEER or appropriate agency prior to implementation.
3. Maintenance of traffic control during the WORK.
4. Monitoring traffic control during the WORK to determine necessary changes required to maintain adequacy.
5. Maintenance of traffic control during non-work hours to maintain adequacy.
6. Removal of temporary traffic control systems after completion of the WORK.
7. Removal of traffic detector loops/detouring vehicles through signalized intersections.

C. The CONTRACTOR shall comply with Section 7058 of the Business and Professions Code as it applies to establishment of traffic control.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. State of California, Department of Transportation (Caltrans) Specifications and Standards:

1. Standard Specifications:

Section 7	Legal Relations and Responsibility
Section 12	Construction Area Traffic Control Devices

2. Standard Plans

3. Traffic Manual, current edition

B. Commercial Standards:

State of California, Division of Industrial Safety, Department of Industrial Relations:

Safety Orders of the Division of Industrial Safety, Department of Industrial Relations of the State of California, current edition.

C. State Codes: State of California Business and Professions Code.

1.03 CONTRACTOR SUBMITTALS

A. In addition to the submittal requirements of Section 011100 "Summary of Work," the CONTRACTOR shall provide the following at the pre-construction conference:

1. A "Letter of Responsibility," on company letterhead, indicating the names and telephone numbers of at least three different persons who shall be available to be contacted in case of emergency at any time during the life of the contract. Said persons must have decision-making authority within the company.

2. "Traffic Control/Construction Staging Plans" indicating proposed traffic control measures during all stages of the WORK. These plans shall be submitted for review and approval by the ENGINEER in order to determine the CONTRACTOR'S compliance with the requirements of this section.

B. The CONTRACTOR shall be responsible for submitting separate applications for encroachment permits to the appropriate agencies for WORK or traffic control within areas outside of the jurisdiction of the CITY. The CONTRACTOR shall be responsible for compliance with all traffic control requirements determined necessary by other permitting agencies or other public authorities acting within their jurisdictions.

1.04 PRODUCTS

A. All construction area stationary and portable sign panels, lights, barricades, and traffic control devices shall be the product of a commercial sign or safety device manufacturer conforming to the requirements of Section 12, "Construction Area Traffic Control Devices," of the Caltrans Standard Specifications, unless otherwise specified in this Section, shown on the Drawings, and/or as directed by the ENGINEER.

1.05 GENERAL

A. The CONTRACTOR shall provide all appropriate traffic control measures in accordance with this Section prior to start of construction in the public right-of-way or in any area adjacent to the street right of way where public safety is affected.

B. The CONTRACTOR shall take all necessary precautions for the protection of the WORK and the safety of its employees and the public. Traffic shall be maintained through the construction or maintenance zone in accordance with Sections 7-1.08, 7-1.09 and 12 of the Caltrans Standard Specifications and Sections 011100 "Summary of Work."

C. Proposed traffic control plans shall be approved by the ENGINEER and any other public agency with jurisdiction over the roadway prior to installation.

D. All construction area signs, lights, barricades, and traffic control devices shall be furnished, installed, maintained, and removed in conformance with the specifications of the Caltrans Traffic Manual, current edition, as published by the State of California Department of Transportation and Business and Professions Code Section 7058. Additional or alternate signs may only be used when specifically authorized by the ENGINEER.

E. The CONTRACTOR shall station guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by these Technical Specifications, the ENGINEER, or other public authorities acting within their jurisdictions. Section 12-2.02 of the Caltrans Standard Specifications is revised to provide that all flaggers and guards shall be furnished by the CONTRACTOR at its expense.

F. The CONTRACTOR shall monitor traffic and safety conditions and maintain adequate traffic control measures during both work and non-work hours in order to maintain compliance with the requirements of this Section.

G. The CONTRACTOR shall conform to all requirements of the current "Safety Orders of the Division of Industrial Safety, Department of Industrial Relations of the State of California."

H. If a hazardous condition is observed and the CITY notifies the CONTRACTOR either directly or by telephone, the CONTRACTOR shall correct the condition immediately. If the CONTRACTOR fails to correct the hazardous condition immediately, the CITY reserves the right to call in a local contractor to perform the necessary work needed to improve public safety. The cost incurred shall be billed to the DEVELOPER.

I. All construction area signs, lights, barricades, and temporary traffic control devices shall be completely removed from the roadway when not in use. Locations and methods of storing traffic control equipment adjacent to the roadway between interrupted use shall require prior approval of the ENGINEER.

J. The CONTRACTOR shall completely remove all temporary signs, striping and/or delineators and restore the pavement, as necessary, upon removal or relocation of any temporary traffic controls or detours constructed as part of the WORK.

K. When traffic is detoured to the bicycle/parking lane adjacent to the curb where street tree branches are interfering with vehicular traffic, the CONTRACTOR shall trim the trees in accordance with Section 311300 "Selective Tree and Vegetation Trimming and Removal."

L. When the construction activity will make any detector loop at a traffic signal inoperative for a period of 72 hours or more, the CONTRACTOR shall provide video detection, or any other similar device which is not installed in the pavement prior to the start of work at his own expense. The CONTRACTOR shall provide a temporary video detection device attached to the traffic signal pole luminaire arm which is wired to the traffic signal controller. The proposed detection device must conform to Section 344100, or as approved by the ENGINEER.

- END OF SECTION -

SECTION 015600

PROTECTION OF EXISTING FACILITIES

1.01 GENERAL

A. The CONTRACTOR shall protect all existing utilities, trees, shrubbery, landscaping, irrigation facilities, buildings, fences, roadside signs, poles, mailboxes, and all other improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.

B. The CONTRACTOR shall verify the exact locations and depths of all utilities shown and the CONTRACTOR shall make exploratory excavations of all utilities that my interfere with the WORK. When such exploratory excavations show the utility location as shown to be in error, the CONTRACTOR shall so notify the DEVELOPER'S ENGINEER and the ENGINEER.

C. Private hose bibs and hoses shall not be used for construction unless the CONTRACTOR secures the owner's permission to use same.

D. All reference markings made by the CONTRACTOR shall be done with spray chalk and shall be removed by the CONTRACTOR.

1.02 PROTECTION OF STREET OR ROADWAY MARKERS

A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers unless specifically shown on the Drawings. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. All survey markers or points disturbed by the CONTRACTOR shall be accurately restored to the satisfaction of the Engineer by the CONTRACTOR at its own expense.

1.03 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The CONTRACTOR shall protect all Underground Utilities and other improvements which may be impaired during construction operations. It shall be the CONTRACTOR'S responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Utilities to be Moved: In case it shall be necessary to relocate or move the property of any public utility or franchise holder, the CONTRACTOR shall be responsible to contact the appropriate utility or franchise holder.

C. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or the facility at the direction of the affected utility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. Underground Utilities: The CONTRACTOR shall notify the appropriate utility or agency for any existing utility lines that are damaged or exposed during construction.

E. The CONTRACTOR shall keep existing streets free from dust and debris during all phases of construction.

1.04 TREES WITHIN STREET RIGHTS-OF-WAY

A. General: The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the CITY or other jurisdictional agency. Trees and shrubs which are not scheduled for removal shall be protected with temporary fencing placed around their driplines. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company and to the satisfaction of said CITY and/or other jurisdictional agency. Tree trimming and replacement shall be accomplished in accordance with the requirements of the CITY or other jurisdictional agency.

1.05 NOTIFICATION BY THE CONTRACTOR

A. The CONTRACTOR shall notify all utilities 48 hours prior to any excavation so that their lines can be marked. Those to be notified include, but are not limited to:

1. Underground Service Alert (USA), 800-227-2600.

B. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, irrigation, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the CONTRACTOR shall notify the Underground Service Alert agency and the respective authorities representing the owners or agencies responsible for such underground facilities 48 hours prior to the day of excavation so that a representative of said owners or agencies can be present during such work if they so desire.

END OF SECTION

SECTION 015700 - SITE PREPARATION

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to protect or control traffic, surface drainage, pedestrians, noise, dust and any nuisance conditions created by construction and shall perform all work required to protect existing streets, curbs, gutters, sidewalks, access ramps, driveways, utilities, landscaping, fences and other existing improvements as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 310000	Earthwork.
B.	Section 312300	Utility Earthwork.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **State of California (Caltrans):**

1. Standard Specifications.
2. Standard Plans.
3. Manual of Traffic Controls for Construction and Maintenance Work Zones.
4. Traffic Manual.

B. ***Commercial Standards:***

1. USA/Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall obtain and submit copies of all permits required by governing agencies prior to any construction.

B. The CONTRACTOR shall submit to the ENGINEER those drawings required in PART 2 - PRODUCTS of this Section outlining all methods and materials intended to protect existing features and control local conditions prior to construction.

PART 2 – PRODUCTS

2.1 GENERAL

A. All products shall conform to State, Federal and local standards as well as manufacturers' printed recommendations.

2.2 SAFETY AND NOISE BARRIERS

A. If the proximity of existing features will require construction of an appropriate barrier such as temporary fencing, berms, acoustic barriers, or similar facilities the CONTRACTOR shall prepare a

submittal for review to the ENGINEER of drawings that define the proposed safety or noise barriers, including any required signage, prior to beginning any construction.

2.3 TRAFFIC CONTROL

A. If the proximity of existing streets or access ways will require construction of appropriate safety barriers, flagging, trench plates, temporary lanes, warning signs, lane striping or similar facilities the CONTRACTOR shall prepare a submittal for review to the ENGINEER of drawings that define the proposed traffic control devices prior to beginning any construction. The submittal shall be submitted in accordance with the latest edition of the State of California (Caltrans) Traffic Manual, and Manual of Traffic Controls for Construction and Maintenance Work Zones.

2.4 SURFACE DRAINAGE

A. If the proximity of existing surface drainage will require construction of appropriate bypass, appropriate bypass, interceptors, or similar facilities the CONTRACTOR shall prepare a submittal for review to the ENGINEER of drawings that define the proposed drainage devices prior to beginning any construction.

PART 3 -- EXECUTION

3.1 SITE INSPECTION

A. Prior to moving onto the project site the CONTRACTOR shall visit and inspect the site conditions and review maps of the existing site and facilities delineating existing utilities, property and right-of-way lines.

3.2 SITE MOBILIZATION

A. All safety, noise, traffic, drainage control and other features required for construction shall be established at the site prior to any construction.

B. The CONTRACTOR shall notify and coordinate the utility location services of all agency utilities affected by the construction work. In addition, the Underground Services Alert (USA) organization shall be used to locate and mark underground utility locations prior to construction in each affected area.

3.3 SITE ACCESS

A. The CONTRACTOR shall install any necessary access to the site, including barrier facilities to be installed at the beginning of construction to prohibit entry of unauthorized persons.

3.4 SITE CLEARING, GRUBBING, AND STRIPPING

A. All clearing, grubbing and stripping shall be in accordance with Section 310000, "Earthwork," and Section 312300, "Utility Earthwork."

3.5 OVEREXCAVATION, REGRADING, AND BACKFILL

A. All overexcavation, regrading and backfill shall be in accordance with Section 310000, "Earthwork," and Section 312300, "Utility Earthwork."

- END OF SECTION -

SECTION 015713

TEMPORARY EROSION CONTROL

1.01 GENERAL

A. Temporary erosion control shall consist of, but not be limited to, constructing such facilities and taking such measures as are necessary to prevent, control, and abate water, mud, construction materials, hazardous materials and erosion damage to public and private property as a result of the CONTRACTOR'S operations.

B. Conformance with the requirements of this section shall in no way relieve the CONTRACTOR from the CONTRACTOR'S responsibilities, as provided in Section 7-1.01G, "Water Pollution," Section 7-1.11, "Preservation of Property," of the Caltrans Standard Specifications.

C. Construction vehicles and equipment entering existing paved areas shall be free of mud, silt and other debris during all phases of work. No mud, silt and other debris shall be tracked on paved surfaces. If such materials are tracked on the streets or other paved areas both public and private, the CONTRACTOR shall immediately remove these materials prior to these materials entering into the storm drain system.

D. Stockpiling of materials on the street will not be allowed unless otherwise approved by the ENGINEER. The CONTRACTOR shall cover with plastic any construction or excavated materials between October 15th and April 15th which may possibly erode and enter the storm drain system of paved streets or other paved areas both public and private. Stockpiling of dirt on paved areas will not be allowed.

E. The CONTRACTOR shall sweep the work area and clean up the work site daily before leaving the site.

F. If a Storm Water Prevention Plan (SWPP) is required for the project, the CONTRACTOR shall be responsible throughout the duration of the project for installing, constructing, inspecting and maintaining the control measures included in the SWPP and any amendments thereto and for removing and disposing of temporary control measures.

G. By October 15th of each year the temporary erosion control features as are necessary to prevent damage during forthcoming winter season shall be constructed and functioning. If the earthwork in any area has not progressed to a point where any part of the facilities on the temporary erosion control plans for that area can be constructed, the CONTRACTOR shall construct such supplementary temporary erosion control facilities as are necessary to protect adjacent private and public property.

Temporary erosion control measures shall include, but not be limited to, the following:

1. The CONTRACTOR shall conduct operations in such a manner that storm runoff will be contained within the site or channeled into the storm drain system which serves the runoff area. Storm runoff from one area shall not be allowed to divert to another runoff area.

2. Storm drain systems, toe of slope drains, and outlet structures shall be constructed and operating prior to commencing, or concurrently with placing an embankment. Temporary downdrains, drainage structures, and other devices shall be provided to channel storm runoff water into the respective permanent storm drain systems during construction. Mud and silt shall be settled out of the storm runoff before the runoff enters the storm drain system.

3. Embankment areas, while being brought up to grade and during periods of completion prior to final roadbed construction, shall be protected by various measures to eliminate erosion and the siltation of downstream facilities and adjacent areas. These measures may include, but shall not be limited to: temporary downdrains, either in the form of pipes or paved ditches with protected outfall areas; graded berms around areas to eliminate erosion of embankment slopes by surface runoff; confined ponding areas to desilt runoff; and temporary check dams in toe of slope ditches to desilt runoff.

4. Excavation areas, while being brought to grade, shall be protected from erosion and the resulting siltation of downstream facilities and adjacent areas by use of various temporary erosion control measures. These measures may include, but shall not be limited to : check dams; confined ponding areas to desilt the runoff; and protection, such as sandbags around inlets which have not been brought up to grade.

5. Contour graded areas shall be protected against erosion and the resulting siltation of downstream facilities and adjacent areas during grading operations. Various measures may include, but shall not be limited to: the use of graded contour berms to control sheet flow; supplemental grading of large areas around temporary or unfinished inlet structures to provide desilting basins; and temporary ditch paving.

6. From October 15th to April 15th:

   A. During embankment construction, an earth berm or appropriate grading to direct drainage away from the edge of the top of the embankment shall be constructed and maintained on those embankments where earthwork operations are not in progress.

   B. Special attention will be required to protect areas, which have been cleared, and grubbed prior to excavation or embankment operations, and which are subject to runoff during the period from October 15th to April 15th. Temporary measures may include, but shall not be limited to: temporary desilting basins; contour graded ditches; temporary paved and unpaved ditches; and filter fabric fences to contain silt and sediment from runoff.

   C. After each storm, desilting basins shall be checked against their design capacity and if necessary, silt and sediment shall be removed to restore capacity.

1.02 INSPECTION AND MAINTENANCE

A. To ensure the proper implementation and functioning of temporary erosion control measures, the CONTRACTOR shall regularly inspect and maintain the construction site for the control measures identified in the Storm Water Prevention Plan (SWPP). The CONTRACTOR shall identify corrective actions and time frames to address any damaged measures or reinitiate any measures that have been discontinued.

B. During the winter season defined as between October 15th to April 15th, inspections of the construction site shall be conducted by the CONTRACTOR to identify deficient measures, as follows:

   1. Prior to a predicted storm;

   2. After all precipitation which causes runoff capable of carrying sediment from the construction site;

   3. At 24 hours intervals during extended precipitation events; and

4. Routinely, on a minimum twice monthly basis.

If the CONTRACTOR identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected in a timely manner. If the ENGINEER identifies a deficiency in the deployment or functioning of an identified control measure, the CONTRACTOR will be notified in writing and the deficiencies shall be corrected by the CONTRACTOR in a timely manner.

END OF SECTION

SECTION 015719

TEMPORARY ENVIRONMENTAL CONTROLS

1.01 DUST ABATEMENT

A. The CONTRACTOR shall furnish all labor, equipment, and means required and shall carry out effective measures at all times during construction to prevent its operation from producing any airborne dust nuisance and dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity all in conformance with Section 10, "Dust Control", and Section 18, "Dust Palliative" of the Caltrans Standard Specifications. The CONTRACTOR shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER.

B. Reclaimed water, as specified in Section 015100, "Temporary Utilities" is available for CONTRACTOR's use for dust abatement.

C. Upon failure of the CONTRACTOR to remove the dust nuisance as specified in Paragraph A within 2 hours after notification by the ENGINEER, the CITY may order that such work be done by others, and all costs therefore shall be charged to the DEVELOPER.

1.02 RUBBISH CONTROL

A. During the progress of the Work, the CONTRACTOR shall not allow any rubbish or construction debris to blow or travel off the construction site. The CONTRACTOR shall keep all public streets and roads free from mud, dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable laws and regulations.

1.03 SANITATION

A. The CONTRACTOR shall insure that adequate existing sanitation facilities are available or the CONTRACTOR shall provide and maintain adequate sanitation facilities. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR'S operations shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto. Sanitation facilities will not be allowed in public street rights-of-way or in public lands. If more than four sanitation facilities are being used on a particular site, the CONTRACTOR shall locate these facilities no closer than 100' from existing residential units.

1.04 CHEMICALS

A. All chemicals used during project construction whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

1.05 CULTURAL RESOURCES

A. The DEVELOPER'S attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470 and 36 CFR 800) which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. The DEVELOPER shall perform remediation in conformance with the requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources.

C. In the event potential cultural resources are discovered during subsurface excavations in the public street right-of-way or on public lands, the CONTRACTOR shall immediately cease all operations and shall immediately notify the ENGINEER.

1. The DEVELOPER shall be responsible for hiring a qualified archaeologist to assess the value of such potential cultural resources and make a recommendation to the State Water Resources Control Board Cultural Resources Officer.

2. The DEVELOPER shall obtain all necessary permits from the CITY Historic Preservation Committee.

D. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Water Resources Control Board Cultural Resources Officer, the CONTRACTOR shall suspend work at the location of the find.

1.06 CONSTRUCTION NOISE

The CONTRACTOR shall be advised that the operation of any noise creating blower, power fan, or internal combustion engine which causes noise due to the explosion of operating gases or fluids is prohibited between the hours of 11:00 p.m. to 7:00 a.m. The operation between the hours of 8:00 p.m. and 7:00 a.m. of any pile driver, steam shovel, pneumatic hammer, derrick, steam, electric hoist, sandblaster or other equipment used in construction, demolition or other repair work, the use of which is attended by loud or unusual noise, is prohibited.

In addition, to the above noise requirements, the CONTRACTOR shall comply with all other requirements of Chapter 9.36 "Noise" of the Livermore Municipal Code.

END OF SECTION

SECTION 016600

MATERIALS AND EQUIPMENT

1.01 SALVAGE OF EXISTING FACILITIES

A. Any existing public or CITY facilities to be removed as directed by the ENGINEER shall be salvaged by the CONTRACTOR and delivered to the CITY facility as directed by the ENGINEER.

B. The CONTRACTOR shall carefully remove, in a manner to prevent damage, any and all materials and equipment specifically designated by the ENGINEER to be removed and salvaged.

C. Any items damaged during the removal, storage, or handling as a result of carelessnes, negligence, or improper procedures shall be replaced by the CONTRACTOR with corresponding items of equal or greater value.

D. The CONTRACTOR may at its option and on approval of the CITY furnish and install new items inlieu of those indicated to be salvaged or reused, in which case the original items shall become the property of the CONTRACTOR and shall be removed from the site after completion of the WORK. The cost of substituting new items in lieu of salvaged or revised items, at the CONTRACTOR'S option, shall be the responsibility of the CONTRACTOR.

E. Existing materials and equipment removed by the CONTRACTOR shall not be reused in the WORK, except where otherwise called for in the contract documents.

END OF SECTION

SECTION 017123

FIELD ENGINEERING

1.01 SUMMARY

A. The CONTRACTOR shall lay out and install all construction to lines and grades in accordance with the Drawings.

B. The CONTRACTOR shall be responsible for setting and maintaining all field engineering, establishing lines and grades, and for the accuracy of the stake information. All horizontal and vertical stake datum shall agree with the Drawings.

END OF SECTION

SECTION 017700

PROJECT CLOSEOUT

1.01 GENERAL

A. ALL construction shall meet the Public Works Occupancy Requirements prior to any building occupancy. Public works occupancy requirements include, but are not limited to, the following:

1. All underground facilities
2. Asphalt concrete pavement
3. Portland cement concrete improvements which may include, but not limited to: curb; gutter; sidewalk, driveways, and access ramps
4. Finish grading within the street right-of-way
5. Street name signs
6. Traffic regulatory signs, striping, and markings
7. Street lights installed and energized
8. Fire hydrants installed and accepted
9. All potential hazards removed within the street right-of-way
10. Street, and sidewalks and driveways cleaned
11. Water meters and boxes installed
12. Sanitary sewers cleaned out
13. Street trees installed *
14. All conditions of approval complied with

* The DEVELOPER may provide a tree bond in order to receive occupancy.

1.02 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove all rubbish, debris, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the CITY will be withheld until the CONTRACTOR has satisfactorily complied with the foregoing requirements for final cleanup of the project site.

1.03 FINAL SUBMITTALS

A. The CONTRACTOR, prior to final acceptance, shall submit the following items to the ENGINEER:

1. Written guarantees or warranties
2. Record drawings as specified in Section 013300 "Submittals."

3. Completed Pavement Management Form

4. Maintenance stock items, including special parts; spare parts; special tools

5. Signed-off permits and/or certificates of inspection and acceptance by local governing agencies having jurisdiction

6. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

END OF SECTION

SECTION 022100 - MONUMENTS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install cast-in-place Portland Cement Concrete survey monuments and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
C.	Section 321300	Concrete Surface Improvements
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM A 48	Specification for Gray Iron Castings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 FRAME AND COVER

A. Monument frame and covers shall be grey iron castings conforming to ASTM A 48, Class 30. Monument cover shall be marked "Monument." Each cover shall be ground or otherwise finished so that it will fit in its frame without rocking. Monument frame and cover shall be **Phoenix Iron Works P-2501, Monroe #9279, or equal.**

2.2 BRONZE SURVEY MARKER

A. Bronze survey markers shall be a 2-1/2 inch domed disk with stem and appropriate survey information as specified on the Drawings.

2.3 FORMING TUBE

A. Tubes for forming portland cement concrete collar and monument shall be a non-metallic type of the size and dimensions shown on the Drawings.

2.4 PORTLAND CEMENT CONCRETE

A. Portland Cement Concrete for collars and footings shall be Class C in conformance with Section 033050, "Utility Cast-in-Place Concrete."

2.5 ASPHALT CONCRETE PAVEMENT

A. Asphalt concrete for monuments shall be in conformance with "Fine Asphalt Concrete Paving" in PART 2 – "Products" of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

2.6 DRAIN ROCK

A. Drain rock material shall be in conformance with Permeable Material, Class 1 or 2, in PART 2 – "Products" of Section 312300, "Utility Earthwork."

PART 3 – EXECUTION

3.1 GENERAL

A. Monuments shall not be installed until the asphalt concrete pavement has been completed. Monuments shall be installed at the locations shown on the Drawings.

B. Concrete, form tube, bronze survey marker, frame and cover, and asphalt concrete shall be installed as shown on the Drawings.

3.2 PORTLAND CEMENT CONCRETE

A. Hand mixing of the Portland Cement Concrete for use in constructing monuments will be allowed.

B. All portland cement concrete shall be placed and thoroughly consolidated.

3.3 ASPHALT CONCRETE PAVEMENT

A. Asphalt concrete for pavement shall be placed in conformance with PART 3 – "Execution" of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.4 DRAIN ROCK

A. Drain rock material shall be installed in conformance with Section 312300, "Utility Earthwork," and shall be compacted to 95 percent relative compaction.

- END OF SECTION -

SECTION 024100 - DEMOLITION

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to perform and complete all demolition work shown on the Drawings and as specified herein. This includes, but is not necessarily limited to, such items as demolition, removal, recycling and disposal of asphalt concrete, miscellaneous concrete, vegetation and all other structures, or features as required.

B. Manufactured articles, materials, equipment, and accessories shall be demolished in accordance with the manufacturer's printed specifications and recommendations, and industry standards, unless otherwise shown or specified.

C. Hazardous materials shall be handled, removed and disposed of in accordance with all regulatory agency requirements.

D. Building utilities shall be disconnected, removed, capped and identified in accordance with the appropriate agency requirements.

E. The CONTRACTOR shall coordinate with the CITY for demolition permits required by the CITY and with all other regulatory agencies and utility companies.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The demolition and sealing of wells, septic tanks and underground tanks shall be in accordance with regulatory agency requirements. The CONTRACTOR shall obtain all required permits and file all required reports.

B. **Commercial Standards:**

1. USA Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. **Demolition Schedule:** The CONTRACTOR shall submit a complete coordination schedule for demolition work including shut-off and continuation of utility services prior to start of the work. The schedule shall indicate proposed methods and operations of facility demolition, and provide a detailed sequence of demolition and removal work to ensure uninterrupted operation of occupied areas.

B. The CONTRACTOR shall provide copies of written agreements from private land owner's, landfill operators, or other agencies accepting disposal of any demolished material prior to any work.

1.5 JOB CONDITIONS

A. **Condition of Facilities:** The CITY assumes no responsibility for actual condition of facilities to be demolished. The CONTRACTOR shall visit the site and inspect the existing facilities.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION

3.1 OCCUPANCY AND POLLUTION CONTROL

A. Water sprinkling, temporary enclosures, chutes and other suitable methods shall be used to limit dust and dirt rising and scattering in the air. The CONTRACTOR shall comply with all government regulations pertaining to environmental protection.

B. Water shall not be used in a manner that creates hazardous or objectionable conditions such as ice, flooding, or pollution.

3.2 PROTECTION

A. Safe passage of persons around area of demolition shall be provided in accordance with all safety and regulatory requirements. Operations shall be conducted to prevent damage to adjacent buildings, structures, other facilities, people and property.

B. Interior and exterior shoring, bracing, or supports shall be provided to prevent movement, settlement or collapse of structures to be demolished and to adjacent facilities to remain.

C. Existing landscaping materials, structures, and appurtenances which are not to be demolished shall be protected and maintained as necessary.

D. The CONTRACTOR shall protect and maintain conduits, drains, sewers, pipes and wires that are not to be demolished.

3.3 SMALL STRUCTURE DEMOLITION

A. Small structures may be removed intact when acceptable to the ENGINEER and approved by the City Building Official.

B. Demolition shall proceed in a systematic manner, typically from top of structure to ground.

C. Concrete and masonry shall be demolished in small sections.

3.4 BELOW-GRADE DEMOLITION

A. Footings, foundation walls, below-grade construction and concrete slabs on grade including utility lines shall be demolished and removed to a depth which will not interfere with new construction but shall not be less than 12 inches below existing ground surface or future ground surface, whichever is lower.

B. Below-grade areas and voids resulting from demolition of structures shall be completely filled.

C. All fill and compaction shall be in accordance with Section 312300, "Utility Earthwork."

D. All fill and compaction surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as shown on the Drawings.

E. Where installation of new utilities require partial removal or demolition of an existing utility, the existing utility shall be removed to sound material. Pipes to be demolished that require no future connection shall be removed to the extent required and sealed and capped. Sanitary sewer laterals shall be removed as required and a new two-way sewer clean out shall be installed in accordance with the Standard Specifications and Details. Pipes to be demolished that require a connection shall

be removed to the extent required to install the new connection. Pipe sections shall be removed either by sawcutting, removing a complete pipe section to an existing joint, or other adequate means which results in a clean joint.

F. The CONTRACTOR shall demolish and seal all wells, septic tanks and underground tanks in accordance with applicable regulatory agency requirements and permits.

G. Joint domestic/fire service laterals shall be abandoned as follows:

1. The Blow Off Assembly shall be removed and capped underground.
2. At the connection to the main the existing lateral valve shall be removed and a blind flange shall be installed on the tee at the main. The lateral pipe shall be abandoned in place by capping both ends of the lateral pipe.
3. The existing structural section of the roadway shall be replaced in kind in accordance with the City Standard specifications.

3.5 AT GRADE DEMOLITION

A. All asphalt concrete and all portland cement concrete curbs, gutters, sidewalks, access ramps and driveways shall be saw-cut at the nearest scoreline or deep joint and removed entirely to the saw-cut limits. Where adjacent pavement or concrete is broken or deteriorated sufficiently to prohibit a sound replacement the entire deteriorated section shall be removed to the limits determined by the ENGINEER.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Demolition and removal of debris shall be conducted to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the CITY. Alternate routes shall be provided around closed or obstructed traffic ways.

B. Site debris, rubbish and other materials resulting from demolition operations shall become the property of the CONTRACTOR and shall be removed by the CONTRACTOR at the CONTRACTOR's expense to a suitable site. The proper and legal disposal of demolished materials shall be the responsibility of the CONTRACTOR.

3.7 PATCHING AND REPAIRING

A. The CONTRACTOR shall provide patching, replacing, repairing and refinishing of damaged areas or damaged adjacent facilities involved in the demolition. New concrete shall match the existing adjacent surfaces, in kind or of better quality, to the satisfaction of the ENGINEER, at no cost to the CITY or to the owners of the facilities.

3.8 CLEANUP

A. During and upon completion of work the CONTRACTOR shall promptly remove unused tools and equipment, surplus materials, rubbish, debris and dust and shall leave areas affected by work in a clean, approved condition.

B. The CONTRACTOR shall clean adjacent structures and facilities of dust, dirt and debris caused by demolition, as directed by the ENGINEER or governing authorities, and return adjacent areas to condition existing prior to start of work.

C. The CONTRACTOR shall clean and sweep daily all street and roads affected by its operation.

- END OF SECTION -

SECTION 033500 - TEXTURED CONCRETE PAVING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place all textured concrete paving which may include but is not necessarily limited to, preparation of subgrade, aggregate base, reinforcement, concrete, colored hardener, colored curing compound, acrylic sealer, special imprinting tools and all other appurtenant work, complete in place as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 310000	Earthwork.
B.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
C.	Section 321300	Concrete Surface Improvements.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 19	Earthwork.
Section 26	Aggregate Bases.

B. **Commercial Standards:**

ASTM C 33	Specifications for Concrete Aggregates.
ASTM C 150	Specifications for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM D 1751	Specifications for Preformed Expansion Joint Filter for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.4 CONTRACTOR SUBMITALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. If requested, the CONTRACTOR shall provide a 2-foot by 2-foot square shop sample to be approved by the Engineer prior to start of construction.

1.5 QUALITY ASSURANCE

A. Textured concrete paving shall be installed by a licensed specialty CONTRACTOR.

B. All work shall comply with the current specifications and quality standards issued by the manufacturer.

PART 2 -- PRODUCTS

2.1 AGGREGATE BASE

A. Aggregate base shall be class 2, 19 millimeter maximum size grading, aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications.

2.2 REINFORCEMENT AND DOWELS

A. Steel bar for textured concrete paving reinforcement and dowels shall be deformed billet-steel bars of the size or sizes as specified on the Drawings and shall be in conformance with PART 2 - PRODUCTS of Section 321300, "Concrete Surface Improvements."

2.3 PORTLAND CEMENT CONCRETE

A. Portland cement concrete for textured concrete paving shall have a minimum 28 day compressive strength at 3000 psi.

B. Portland cement shall be Type II cement conforming to ASTM C 150.

C. Aggregate shall be minus 3/8-inch to 1 inch conforming to ASTM C 33.

D. When textured concrete paving is installed in the travelway, aggregate shall be minus 1-inch conforming to ASTM C33.

E. An air-entraining agent conforming with ASTM C 260 and/or a normal set or retarded set water reducing admixture conforming with ASTM C 494 may be used.

F. Calcium chloride shall not be permitted in the mix.

2.4 EXPANSION JOINT MATERIAL

A. Expansion joint material shall be premolded expansion joint filler 1/2-inch thick in conformance with ASTM D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete improvements prior to being placed.

2.5 COLOR HARDENER

A. Color hardener shall be a ready to use, regular grade, dry-shake color hardener and shall be streak-free integregations of pigments, surface conditioning and dispersing agents, and portland cement blended with hard, graded aggregate.

2.6 COLORED CURING COMPOUND

A. Colored curing compound shall be in conformance with ASTM C 309 and shall conform with all applicable air pollution regulations.

2.7 ACRYLIC SEALER

A. A colored acrylic sealer may be used in lieu of a colored curing compound in accordance with the manufacturer's recommendations. A clear acrylic sealer may be used if textured concrete paving is multicolored.

PART 3 -- EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall be in conformance with Section 310000 "Earthwork" and Section 321000 "Asphalt Pavement, Base and Surface Treatment."

B. Finish subgrade shall be within the tolerances established in Section 19-1, "General," of the Caltrans Standard Specifications.

3.2 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with PART 3-Execution of Section 321000 "Asphalt Pavement, Base and Surface Treatments." The aggregate base shall be placed to the depth as shown on the Drawings.

3.3 CONCRETE REINFORCEMENT

A. Concrete reinforcement and dowels shall be placed at the location as shown on the Drawings. Installation of concrete reinforcement and dowels shall be in conformance with Section 033050 "Utility Cast-in Place Concrete."

3.4 INSTALLATION OF TEXTURED CONCRETE PAVING

A. Textured concrete paving shall be installed to the dimensions as shown on the Drawings.

B. The concrete shall be placed and screeded to the finished grade and floated to a uniform surface in accordance with the manufacturer's recommendations.

C. The Contractor shall use manufacturer approved imprinting tools to make the desired impression to the surface of the concrete while the concrete is still in the plastic stage of set.

3.5 COLOR HARDENER

A. Color hardener shall be applied evenly to the concrete surface by the dry-shake method using a minimum of 60 pounds per 100 square feet in accordance with the manufacturer's recommendations.

B. Color hardener shall be applied in two or more shakes, floated after each and troweled only after the final floating.

3.6 EXPANSION JOINTS/DEEP JOINTS

A. Expansion joints shall be placed continuously between all textured concrete paving surfaces and concrete surfaces.

B. Deep joints shall be placed to a depth of 1/4 of the thickness of the textured concrete paving at a minimum spacing equal to 1.5 times the width of the textured concrete paving unless otherwise recommended by the manufacturer.

- END OF SECTION -

SECTION 034800 - PRECAST CONCRETE VAULTS, UTILITY BOXES, AND STORM WATER FIELD DROP INLETS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all precast items as required, including all appurtenances necessary to make a complete installation as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 033050	Utility Cast-In-Place Concrete.
B.	Section 033500	Grout.
C.	Section 055000	Miscellaneous Metalwork.
D.	Section 330526	Piping Identification Systems.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ACI 318	Building Code Requirements for Reinforced Concrete.

1.4 CONTRACTOR SUBMITTALS

A. **Shop Drawings:**

1. The CONTRACTOR shall submit Shop Drawings for all specialty precast concrete items. Submitted drawings shall show design criteria, all dimensions, location and type of lifting inserts, and details of reinforcement and joints.

2. For all precast items which are manufactured, the CONTRACTOR shall also submit a list of the design criteria and product data sheets used by the manufacturer.

B. **Certification of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 DEFINITIONS

A. In these Specifications, where the terms "Precast Concrete," "Prefabricated Concrete" and "Precast Concrete Specialties" are used, they shall have equivalent meaning.

PART 2 – PRODUCTS

2.1 MANUFACTURED ITEMS

A. **Miscellaneous Precast Vaults:**

1. Vault dimensions shall be as required by the specific installations and shall meet all required clearances.

2. Vaults shall be **Christy, Utility Vault Co. or equal.**

3. The vault frames shall be provided by the vault manufacturer. Vault covers shall be steel checker plate or vault access doors as specified and shall conform to Section 055000, "Miscellaneous Metalwork." When leveling bolts are used to set the vault top sections, the CONTRACTOR shall ensure that the load on the vault will be transferred through the mortar to the vault, and will not be carried by the leveling bolts.

4. Where vaults are in areas which may be subjected to vehicular traffic vault, frame and cover shall be designed for HS-20 traffic loading.

5. Vaults larger than 24 inches by 36 inches shall have vault access doors, with hinged meter reading lids when specified, and shall be located as specified or as shown on the Drawings.

B. **Utility Boxes:**

1. Utility boxes shall be sized as shown on the Drawings or shall meet the minimum clearance requirements as specified or as required for the intended use.

2. Utility boxes shall have covers that are designed by the manufacturer for HS-20 traffic loading in streets and driveways subject to vehicular traffic. The covers shall be embossed "Water," "Sanitary Sewer," or "Recycled" as appropriate. All water meter utility box covers shall have touch read recess holes in the lid.

3. Utility boxes larger than 22 inches by 36 inches shall have two piece steel checker plate lids and shall be located as specified or as shown on the Drawings.

4. Utility boxes shall be as manufactured by **Christy or equal.** The following table lists standard model numbers for Christy:

Service	Christy Box/lid*
a. Water Meters:	
Piston Meter Boxes	
5/8"	B-9/B-9P*
3/4"	B-12/B12P*
1"	B-16/B16P*
1-1/2"	B-36/B36P*
2"	B-36/B-36-61P*
Turbine Meter Boxes	
1-1/2"	B-36/B-36P*
2"	B-36/B-36P*
3"	Special design as approved by the City
b. Valve Boxes, Water Line Angle Marker Boxes	G-5/G5C
c. Sampling Station, Blow-Off and Angle Meter Stop Boxes	B-9/B-9*
d. Air Release Valves (1" and 2")*	B-24/B24-D (1" and 2" valves)
e. Sanitary Sewer:	
Clean Out Boxes	F8/F8*

* Utility boxes located in streets or driveways shall have cast-iron covers. Water meter boxes located in driveways shall have steel checker plate covers with a reading lid. All other utility boxes shall have reinforced concrete covers or polymer concrete covers.

5. Utility boxes in landscape areas, unimproved areas, and field installations shall have bolt or screw down lids or covers.

6. Utility boxes for blow-off valves on pipelines greater than 12" shall be Christy Box/lid B-30/B-30D* or equal and as shown on the DRAWINGS.

C. **Storm Water Field Drop Inlets:**

1. Frame and grate or cover plate shall be of the same manufacturer as the pre-cast inlet and shall be hot-dip galvanized after fabrication.

2. Precast storm water field drop inlets frame and grate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

3. **Storm water field drop side-opening inlet:** Precast storm water field drop side-opening inlets shall be **Santa Rosa, Type C, or equal.** Frame and grate or cover plate shall be in conformance with Section 055000, "Miscellaneous Metalwork."

2.2 PREFORMED JOINT SEALANT

A. On vaults the joint sealing compound shall be a preformed, cold- applied, ready to use plastic joint sealing compound **Quick-Seal, Ram-Nek; or equal.**

2.3 NON-SHRINK GROUT

A. Non-shrink grout shall be as specified in the Section 033500, "Grout."

PART 3 – EXECUTION

3.1 MANUFACTURED ITEMS

A. Precast Concrete Vaults, Utility Boxes and Field Storm Water Inlets shall be installed in accordance with the manufacturer's printed recommendations, and as shown on the Drawings.

B. Connections to precast vaults, utility boxes, and field storm water inlets shall be made by installing pipe sections into the structure wall using non-shrink grout as specified in Section 033500, "Grout." A water stop shall also be installed on all plastic pipes.

C. All utilities shall be identified as specified in Section 330526, "Piping Identification Systems."

D. Construction grade redwood shims and one-piece boards shall be installed as shown on the Drawings.

- END OF SECTION -

SECTION 036000 - GROUT

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place grout and shall form, mix, place, cure, repair, finish, and do all other work as necessary to produce finished grout as shown on the Drawings and as specified herein.

B. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: Non-Shrink grout is to be used unless another type is specifically referenced or as shown on the Drawings.

2. Epoxy Grout

3. Cement Grout

C. Cement grout for pressure grouting around steel casing pipes shall be in conformance with Section 330523, "Steel Casing Boring and Jacking."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 330523	Steel Casing Boring and Jacking.
B.	Section 033050	Utility Cast-in-Place Concrete.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 033050, "Utility Cast-in-Place Concrete," and as referred to herein.

B. **Commercial Standards:**

ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-In. or 50-mm Cube Specimens).
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
ASTM C 827	Test Method for Change in Height of Early Ages of Cylindrical Specimens from Cementitious Mixtures.
ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics.
CRD-C 621	Corps of Engineers Specification for Non-shrink Grout.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance**: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-Shrink Grout:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi; shall have no shrinkage (zero percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (zero percent) and a maximum of 0.2-percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28-day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.

4. Application:

   a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

   b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100-percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (zero percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other specified applications.

2.2 CEMENT GROUT

A. **Cement Grout:** Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement shall be as specified in Section 033050, "Utility Cast-in-Place Concrete."

2.3 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is specified, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

2.4 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using appropriate containers. Shovel measurement will not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 – EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 033050, "Utility Cast-in-Place Concrete." The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request.

C. All mixing, surface preparation, handling, placing, consolidation and other means of execution for prepackaged grouts shall be done according to the printed instructions and recommendations of the manufacturer.

3.2 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

- END OF SECTION -

SECTION 310000 - EARTHWORK

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and construct the roadway subgrade and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1 Site Clearing, Grubbing and Stripping.
2. Preparation for Fill Material.
3. Roadway Excavation.
4. Roadway Grading and Compaction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 024100	Demolition.
B.	Section 015700	Site Preparation.
C.	Section 312300	Utility Earthwork.
D.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 16	Clearing and Grubbing.
Section 19	Earthwork.
Section 68	Subsurface Drains.
Section 88	Engineering Fabrics.

B. **Uniform Building Code.**

C. **Commercial Standards:**

ASTM C 117	Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C 136	Method for Sieve Analysis of Fine and Course Aggregates.
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method.

ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 2844	Test Method for Resistance *R*-Value and Expansion Pressure of Compacted Soils.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place By Nuclear Methods (Shallow Depth).
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 _ CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and martials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. All soils testing will be done by a testing laboratory of the CITY'S choice and at the CITY'S expense, except as otherwise specified in this Section.

B. Where soil material is required to be compacted to a percentage of relative compaction, the maximum density at optimum moisture content will be determined in conformance with ASTM D 1557. Field density in-place and moisture content tests will be performed in conformance with ASTM D 2922 and ASTM D 3017, respectively, or by such other means acceptable to the ENGINEER.

C. If the tested materials show non-compliance with the required relative compaction, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance.

D. The CITY will pay the cost of the first test and one re-test. Subsequent re-testing after the first re-test to show compliance shall be at the CONTRACTOR'S expense.

E. The CONTRACTOR shall notify the ENGINEER at least 48 hours prior to performing any site clearing, grubbing, or stripping.

F. Finish subgrade at any point shall not vary more than 0.1-foot above or below the subgrade shown on the Drawings.

1.6 PROJECT CONDITIONS

A. Material for embankments, where required, shall consist of suitable excavated material if available, or such imported fill material as may be required conforming to the requirements of this Section and the appurtenant soils report.

B. The CONTRACTOR shall be solely responsible for the maintenance of the graded surface at all times including implementing all erosion control measures as shown on the drawings during the winter months.

C. The CONTRACTOR shall be solely responsible for provision of adequate site drainage at all times as shown on the grading and erosion control plans during the course of the WORK.

PART 2 – PRODUCTS

2.1 SUITABLE FILL MATERIAL

A. Import fill material shall consist of inert granular soil and rock fragments and shall conform to the requirements of the appurtenant soils report.

B. All fill material, import or native, shall be free of organic materials, trash and debris, moderately to highly expansive clays, or any other deleterious materials, and shall be subject to the approval of the ENGINEER.

C. In addition to the soils report requirements, the top 2 feet of import fill material below the subgrade for the roadway shall conform to the following requirements:

1. Fill material shall conform to the following as determined by ASTM C 117 and ASTM C 136:

a. Maximum particle size	3 inches
b. Percent passing 1-inch sieve	90-100 percent
c. Percent passing No. 200 sieve	less than 20 percent

2. Plasticity Index for acceptable import fill materials shall be a maximum of 15 when determined by the procedure set forth in ASTM D 4318.

3. The liquid limit shall not exceed 40 percent as determined by the procedures set forth in ASTM D 4318.

4. Import fill material shall have an R-value of 25 or greater as determined by ASTM D 2844.

D. The CONTRACTOR shall submit to the ENGINEER at least 10 working days prior to use on the site its proposed source of import fill material along with a soils report and Certification from the designated source that the proposed source materials conform to this Section.

E. All suitable native fill material containing clods or hard lumps of earth over 6 inches in the greatest dimension shall be broken up before compaction. All suitable native fill material consisting of large rocky material or hard lumps, such as hardpan or cemented gravel which cannot be broken readily, shall be well distributed in the lower portions throughout the earthwork.

PART 3 – EXECUTION

3.1 SITE CLEARING, GRUBBING AND STRIPPING

A. Clearing and grubbing shall conform to Section 16, "Clearing and Grubbing," of the Caltrans Standard Specifications and this Section.

B. Unless otherwise shown on the Drawings, clearing and grubbing shall be performed within the entire street right-of-way area. No burning of material will be allowed.

C. The site shall be stripped and cleared of all vegetation, debris and organic-laden top soil as required by the appurtenant soils report. The stripped material shall be removed from the site or stockpiled for landscaping purposes if allowed by the appurtenant soils report. This material shall not be used as import fill.

D. No clearing or grubbing of the site can take place until any environmental review associated with the project, if any, has been completed and approved by the appropriate agencies.

3.2 PREPARATION FOR FILL MATERIAL

A. Prior to placing import fill material, all areas to receive fill shall be scarified and compacted. Unless otherwise stated in the appurtenant soils report, the area shall be scarified to a minimum of 8 inches, material shall be moisture conditioned by wetting or drying to a range of 2 percent to 5 percent over optimum moisture content, and compacted to a density of not less than 90 percent relative compaction in conformance with ASTM D 1557.

3.3 ROADWAY GRADING AND COMPACTION

A. Roadway grading shall consist of grading the site to the lines and grades called for on the Drawings. Roadway grading, placing and compacting shall conform to Section 19-5, "Compaction" and Section 19-6, "Embankment Construction," of the Caltrans Standard Specifications and as modified by this Section.

B. Damage to underlying native soils caused by the CONTRACTOR'S operations shall be repaired and re-compacted under the supervision of and to the satisfaction of the ENGINEER at no additional cost to the CITY.

C. Material for roadway fill shall be placed in lifts or horizontal layers not exceeding 8 inches in un-compacted thickness. Unless otherwise specified in the appurtenant soils report, material shall be moisture conditioned by wetting or drying as specified in Section 3.2 above, and compacted to a density of not less than 90 percent relative compaction in conformance with ASTM D 1557. In addition, in fill areas the upper 2 feet below street subgrade for the width of the traveled way shall be compacted to a density of not less than 95 percent relative compaction in conformance with ASTM D 1557.

D. Final preparation of subgrade shall be in conformance with PART 3 - EXECUTION of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.4 ROADWAY EXCAVATION

A. Roadway excavation shall conform to Section 19-1, "General" and Section 19-2, "Roadway Excavation" of the Caltrans Standard Specifications, except the reference to Section 19-5, "Compaction," is deleted, and except that Section 19-2.02, "Unsuitable Material," is modified as follows:

1. When directed by the ENGINEER, the CONTRACTOR shall excavate the unstable or unsuitable underlying material to the depth determined by the appurtenant soils report.

2. Subgrade shall be prepared in conformance with PART 3 - EXECUTION, of Section 321000, "Asphalt Pavement, Base and Surface Treatments."

3.5 UNDERGROUND STRUCTURES

A. Where abandoned underground structures and pipelines are encountered in the street areas, remove to sufficient depth to allow underground lines to cross, backfill and compact during rough grading. The ENGINEER may require further work to be done if visual inspection indicates during construction.

- END OF SECTION -

SECTION 311300

SELECTIVE TREE AND VEGETATION TRIMMING AND REMOVAL

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to perform the selective tree and vegetation trimming and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Verification of trees and vegetation to be trimmed with ENGINEER.
2. Trimming of trees and other vegetation in the street right of way.
3. Removal of trees and other vegetation as approved by the ENGINEER.
4. Removal of cuttings and clean-up of the jobsite.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321000	Asphalt Pavement, Base, and Surface Treatments.
B.	Section 321200	Flexible Pavement Coatings.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 12	Construction Area Traffic Control Devices.

B. **Commercial Standards:**

1. CAL-OSHA Standards.

2. ANSI Regulations.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit copies of the supervising arborist's certification from the Western Chapter of the International Society of Arboriculture to the ENGINEER prior to performing the WORK.

B. The CONTRACTOR shall submit copies of required resident notifications to the ENGINEER for review prior to distribution. The CONTRACTOR shall follow up each notification and parking restriction posting with submittal to the ENGINEER of a signed affidavit confirming time and date of each notification or posting.

1.5 QUALITY ASSURANCE

A. All trimming work shall be performed under the direct supervision of and in conformance with the recommendations of an arborist certified by the Western Chapter of the International Society of Arboriculture and the City of Livermore Municipal Code Section 12.20.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall be held responsible for any damage to trees, vegetation, or private property caused by its construction operations or trees that die after improper pruning or trimming. At the CITY'S option, the CONTRACTOR shall be assessed for the value of the damage to the trees, vegetation or private property based upon the the International Society of Arborculture's Standard method of valuation.

B. The CONTRACTOR shall furnish all tools and equipment and employ trained tree trimmer personnel under the direction of the arborist to operate all equipment and perform all handwork efficiently and skillfully.

C. The trimming work shall be performed in a safe and proper manner adhering to CAL-OSHA standards and ANSI regulations.

PART 2 – PRODUCTS

2.1 TREE SEALER

A. Tree sealer shall be as manufactured by **Ready to Use "Tre-hold,"** or equal, tree sealer conforming to the following specifications:

1. A commercial grade, quick drying, tree sealer which shall have suitable qualities to coat and seal damaged bark and cuts, and inhibit secondary growth. Application shall be made in accordance with the manufacturer's printed recommendations.

PART 3 – EXECUTION

3.1 ORDER OF WORK

A. Trimming and/or removal shall be performed only on trees or vegetation requiring work in order to conform to the parameters set forth in this Section, unless otherwise directed by the ENGINEER.

B. The CONTRACTOR shall identify all trees and vegetation determined to require trimming or removal with temporary chalk paint markings on the adjacent street travelway for review by the ENGINEER prior to beginning any cutting operations.

C. A list verifying the address and/or location of all trees or vegetation to be trimmed or removed shall be prepared by the CONTRACTOR and submitted to the ENGINEER for review by the City's designated landscape specialist.

D. The CONTRACTOR shall notify all property occupants when trees or vegetation is to be trimmed or removed in accordance with this Section. All written notifications to be distributed to affected property occupants shall be submitted to the ENGINEER for review prior to distribution. The CONTRACTOR shall distribute notifications and post temporary no parking restrictions per this Section a minimum of 72 hours in advance of any cutting operations.

3.2 PUBLIC NOTIFICATION

A. All residents, businesses, and public facilities affected by the WORK shall be provided with prior notification in accordance with Division 1, General Requirements. All notifications shall be in a form of written posting, setting the time and date that the cutting operations will take place. The CONTRACTOR shall follow up each notification with submittal to the Engineer of a signed affidavit confirming time and date of each notification or posting.

B. "No Parking" zones shall also be established where necessary to accomplish trimming operations in conformance with the Division 1, General Technical Requirements.

3.3 TREE AND VEGETATION TRIMMING

A. Tree limbs or other vegetation obstructions shall be trimmed to a minimum height of 11 feet above the roadway, as measured from the lip of gutter, and to 8 feet-9 inches above the sidewalk, as measured from the back of sidewalk. The crown of the tree shall be balanced as necessary. Balancing of the crown of the tree shall be accomplished by thinning, reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs, and sucker growth. Limbs shall be pruned back to an appropriate lateral branch.

B. Tree limbs shall not be torn or ripped. All final pruning cuts shall be clean cuts.

C. Trees and vegetation shall be trimmed in such a manner as not to injure adjacent trees, plants, and/or improvements which are to be preserved.

D. Cuts or damage to areas of tree bark caused by the CONTRACTOR'S trimming operations shall be treated with a sealer such as "Tre-hold," or equivalent, as approved by the ENGINEER. Application of the tree sealer shall be made according to the manufacturer's printed recommendations.

E. All trimmings and debris generated from these operations shall be removed completely from both the public right of way and adjacent private property and properly disposed of in a legal manner in conformance with the Division 1, General Requirements.

- END OF SECTION -

SECTION 311316

ROOT PRUNING

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to perform all root pruning necessary to construct improvements, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
B.	Section 321300	Concrete Surface Improvements.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 12	Construction Area Traffic Control Devices.

B. **Commercial Standards:**

1. CAL-OSHA Standards.
2. ANSI Regulations.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall submit copies of the supervising arborist's certification from the Western Chapter of the International Society of Arboriculture to the ENGINEER prior to performing the WORK.

1.5 QUALITY ASSURANCE

A. All root pruning work shall be performed under the direct supervision of and in conformance with the recommendations of an arborist certified by the Western Chapter of the International Society of Arboriculture.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall be held responsible for any damage to trees, vegetation, or private property caused by its construction operations.

B. The CONTRACTOR shall furnish all tools and equipment and employ sufficient trained personnel to operate all equipment and perform all handwork efficiently and skillfully.

C. The root pruning work shall be performed in a safe and proper manner adhering to CAL-OSHA standards and ANSI regulations.

PART 2 -- PRODUCTS

2.1 ROOT SEALER

A. Root sealer shall be manufactured by **Ready to Use "Tre-hold,"** or equal conforming to the following specifications:

1. A commercial grade, quick drying, root sealer which shall have suitable qualities to coat and seal damaged bark and cuts, and inhibit secondary growth. Application shall be made in accordance with the manufacturer's printed recommendations.

PART 3 -- EXECUTION

3.1 TRAFFIC CONTROL

A. The CONTRACTOR shall use suitable measures, including signs, portable barricades, tape and flaggers, as required in conformance with the Division 1, General Requirements.

3.2 ROOT PRUNING

A. Where concrete repair work occurs adjacent to or over tree roots where damage has been caused by root intrusion, the roots shall be removed to a minimum depth of at least 8 inches below the bottom of the new concrete improvements. Roots shall be cut as far from the tree as possible alongside the edge of the new curb or sidewalk. Roots must be completely severed prior to their removal.

B. If removal of a root is determined by the Arborist to potentially endanger the stability or health of the tree, the CONTRACTOR shall provide the ENGINEER with the findings and avoid cutting the roots until approval from the ENGINEER has been received.

C. Root pruning shall not be performed until after removal of the existing concrete improvements but shall be completed prior to base and subgrade excavations. Root pruning shall be achieved by use of a **Vermeer** root cutter or equivalent method approved by the ENGINEER. Tree roots may occasionally be cut by sawing or chopping with a sharp saw or axe on an individual case basis, but only with the express approval of the Arborist and the ENGINEER.

D. Tree roots shall not be torn or ripped. All final root pruning cuts shall be clean cuts.

E. Cuts on tree roots 1-inch diameter or larger and areas of bark or skin damage caused by root pruning operations shall be treated with a root sealer and growth inhibitor.

F. At sites where excavation has exposed living roots to the air the CONTRACTOR shall cover the exposed roots within 2 hours of exposure with base rock, soil, moist burlap or other means acceptable to the Arborist and the ENGINEER. Inspection by the ENGINEER is required prior to permanent backfill.

G. Roots shall be pruned in such a manner as not to injure adjacent trees, plants and/or improvements which are to be preserved.

H. In addition to root pruning, trimming of the tree crown may be required as determined by the Arborist. Trimming of the tree crown shall be in conformance with PART 3 - Execution of Section 311300 "Selective Tree and Vegetation Trimming and Removal."

- END OF SECTION -

SECTION 312300 - UTILITY EARTHWORK

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to perform and complete all utility earthwork as shown on the Drawings and as specified herein.

B. The work of this Section includes all earthwork required for construction of the project. Such earthwork shall include, but may not necessarily be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work, which shall include, but not necessarily be limited to, the furnishing, placing, and removing of sheeting, shoring and bracing necessary to safely support the sides of all excavations; all pumping, ditching, draining and other required measures for the removal or exclusion of water from the excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork.

C. Hazardous materials shall be handled in accordance with all regulatory agency requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 024100	Demolition.
B.	Section 015700	Site Preparation.
C.	Section 310000	Earthwork.
D.	Section 312323	Controlled Low Strength Materials (CLSM).
E.	Division 2 and 5	Pipe Sections as applicable.
F.	Section 328000	Irrigation Systems.
G.	Section 329113	Landscape Soil Preparation.
H.	Section 329300	Landscape Planting.
I.	Section 331100	Piping, General.
J.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State Codes:**

California Labor Code.

Construction Safety Orders of the State of California.

B. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 25	Aggregate Subbases.
Section 26	Aggregate Bases.
Section 68	Subsurface Drains.
Section 88	Engineering Fabrics

C. **Commercial Standards:**

ASTM D 422	Test Method for Particle-Size Analysis of Soils.
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
ASTM D 2419	Method for Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D 2487	Test Method for Classification of Soils for Engineering Purposes.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
ASTM D 3776	Test Methods for Mass Per Unit Area (Weight) of Woven Fabric.
ASTM D 3786	Method of Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D 4253	Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
ASTM D 4254	Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4491	Test Methods for Water Permeability of Geotextiles by Permittivity.

ASTM D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile.
OSHA	Occupational Safety and Health Administration.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR'S attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The CONTRACTOR, prior to beginning any trench or structure excavation 5 feet deep or over, shall submit to the ENGINEER for review for compliance with Section 6705 the CONTRACTOR'S detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system standards established in the Construction Safety Orders of the State of California, such alternative system plans shall be prepared, stamped and signed by a civil or structural engineer licensed in the State of California at the CONTRACTOR'S expense.

B. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

C. For all materials that are not pre-approved by the CITY the CONTRACTOR shall designate the source and/or submit samples of all materials in advance of their use for required testing and ENGINEER's approval. All testing costs shall be at the CONTRACTOR'S expense.

1.5 QUALITY ASSURANCE

A. **General:** All soils testing will be done by a testing laboratory of the CITY'S choice at the CITY'S expense except as otherwise specified in Paragraph 1.5 C. below.

B. Where soil material is required to be compacted to a percentage of maximum density the maximum density at optimum moisture content will be determined in accordance with ASTM D 1557. Where cohesionless, free draining soil material is required to be densified to a percentage of relative density the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 2922, or by such other means acceptable to the ENGINEER.

C. In case the first test and one re-test of the fill or backfill show non-compliance with the requirements the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent re-testing after the first re-test to show compliance shall be at the CONTRACTOR'S expense.

D. The CONTRACTOR shall notify the ENGINEER at least 48 hours prior to performing any utility excavation.

PART 2 – PRODUCTS

2.1 SUITABLE BACKFILL MATERIALS

A. Suitable Backfill shall be a selected or processed clean, fine earth, rock, or sand, free from objectionable material, vegetation, or other deleterious substances.

B. The following TYPES of backfill materials are designated and defined as follows:

TYPE 1. **Sand** shall be material with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.

TYPE 2. **Class 2 Aggregate Base** shall be crushed rock aggregate base material meeting the requirements of Section 26, "Aggregate Bases," for 19 millimeter maximum grading, of the Caltrans Standard Specifications.

TYPE 3. **Class 1, Type A or B, Permeable Material** shall be crushed stone, or gravel, durable and free from slaking or decomposition under action or alternate wetting or drying, uniformly graded, and shall meet the requirements of Section 68-1.025 for Class 1, "Permeable Material," of the Caltrans Standard Specifications.

TYPE 4. **Class 2 Permeable Material** shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying, uniformly graded, and shall meet the requirements of Section 68-1.025 for Class 2 "Permeable Material," of the Caltrans Standard Specifications.

TYPE 5. **Manufactured Backfill** shall be manufactured, angular, granular, crushed stone, rock, or slag with 100 percent passing a one-inch sieve and less than one percent passing a No. 4 sieve.

TYPE 6. **Controlled Low Strength Materials (CLSM)** shall conform to the requirements of Section 02320 "Controlled Low Strength Materials (CLSM)."

TYPE 7. **Native** material shall be material obtained from on-site excavations, provided the materials are not classified as unsuitable. Native material shall be free of stones, lumps, broken concrete or bituminous surfacing over 4 inches in diameter, objectionable material, vegetation, and deleterious substances.

TYPE 8. **Topsoil** material may be material which has been obtained at the site or may be imported, and shall meet the requirements of Section 02911, "Landscape Soil Preparation." Removal of the topsoil shall be done after the area has been stripped of vegetation and debris as specified.

TYPE 9. **Aggregate Subbase** shall conform to the grading and quality requirements of Section 25, "Class 2 Aggregate Subbase" of the Caltrans Standard Specifications.

2.2 UNSUITABLE BACKFILL MATERIAL

A. Unsuitable soils for backfill material shall include soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, or OL. Types CH and MH soils will be permitted in unimproved areas only where required compaction and stability can be demonstrated. In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classified as unsuitable material.

B. Any material determined to be hazardous is defined as unsuitable material.

C. Washed, smooth rock (pea gravel) is classified as unsuitable material.

D. Where moisture content of the material is not in conformance with Section 310000, "Earthwork," the material will be classified as unsuitable material.

2.3 USE OF SUITABLE BACKFILL MATERIAL TYPES

A. The CONTRACTOR shall use the types of materials as designated herein for all required backfill construction.

B. Backfill material types shall be used in conformance with the following provisions:

1. **Bedding** backfill, as defined under PART 3 - EXECUTION of this Section herein, shall be Sand; Class 2 Aggregate Base; Class 1, Type A Permeable Material; or Class 2 Permeable Material, meeting the requirements of Product Types 1, 2, 3A, or 4.

2. **Pipe Zone** backfill, exclusive of bedding, as defined under PART 3 - EXECUTION of this Section herein, shall be as follows:

   a. Plastic pipe shall be backfilled with Sand meeting the requirements of Product Type 1.
   b. Mortar coated pipe, concrete pipe, and ductile iron pipe shall be backfilled with Sand; Class 2 Aggregate Base backfill material; Crushed Rock or Gravel, meeting the requirements of Product Types 1, 2, 3A, or 4.
   c. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Sand; or natural, rounded, non-crushed material, meeting the gradation requirements of Product Types 1, 3 A, or 4.
   d. Vitrified clay pipe shall be backfilled with Sand, or Manufactured Backfill material, meeting the requirements of Product Type 1 or 5; or Class 2 Aggregate Base; Class 1, Type A Permeable Material; or Class 2 Permeable Material, meeting the requirements of Product Types 2, 3A, or 4, only if properly compacted with hand tampers or vibratory compactors as appropriate.
   e. Backfill for sub-drainage systems shall be designed on a case-by-case basis.

   The pipe zone backfill for all other pipelines excluding those listed above shall be Sand; Class 2 Aggregate Base; Class 1 Type A Permeable Material; Class 2 Permeable Material; Manufactured Backfill; meeting the requirements of Product Types 1, 2, 3A, 4, or 5. **Note:** Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a No. 4 sieve, trench plugs of impermeable clay type material or concrete shall be provided at minimum intervals of 200 feet.

3. Trench **Zone** backfill as defined under PART 3 - EXECUTION of this Section herein, shall be Sand; Class 2 Aggregate Base; Class 1, Type A, Permeable Material; Class 2 Permeable Material; Manufactured Backfill; Native; or Aggregate Subbase meeting the requirements of Product Types 1, 2, 3A, 4, 5, 6, 7, or 9.

4. **Final Zone** backfill as defined under PART 3 - EXECUTION of this Section herein, shall consist of the following materials for each condition listed below.

   a. Final Zone backfill under paved areas shall be Class 2 Aggregate Base, CLSM, or Class 2 Aggregate Subbase, meeting the requirements of Product Types 2, 6, or 9.

   b. Final Zone Backfill in unimproved areas shall be Native or Class 2 Aggregate Subbase meeting the requirements of Product Types 7 or 9.

   c. Final Zone backfill in landscape areas shall be Native meeting the requirements of Product Type 7. Topsoil and amendments shall be Product Type 8 as specified in Section 02911, "Landscape Soil Preparation," and as shown on the Drawings.

   d. Final Zone backfill under graveled roads shall be Class 2 Aggregate Base, CLSM, Native, or Class 2 Aggregate Subbase meeting the requirements of Product Types 2, 6, 7, or 9.

5. **Minor structures.** Backfill materials around minor structures shall be any Trench Zone Product Type except Sand, Native, or Topsoil, Product Types 1, 7, or 8.

6. **Over-excavation** backfill shall be Class 1, Type B Permeable Material meeting the requirements of Product Type 3B. For wet trench conditions place a filter fabric on top and below of the permeable material to prevent migration of fines.

2.4 FILTER FABRIC

A. Filter fabric shall be non-woven synthetic fabric meeting the requirements of Section 88-1.03, "Filter Fabric," of the Caltrans Standard Specifications. Filter fabric shall be non-woven synthetic fabric with a minimum Grab Strength of 90 pounds; a minimum Burst Strength of 180 pounds, a minimum Puncture Strength of 50 pounds, a Water Flow Rate of at least 40 gal/min/sf, and an Apparent Opening Size of between 60 and 110.

2.5 STEEL PLATE

A. When steel plate bridging is provided in-lieu of backfill and temporary asphalt, it shall conform to Section 602.1 of the Caltrans Encroachment Permit Manual, with the following minimum thicknesses:

Trench Width	Minimum Plate Thickness
(10") 0.25 m	(1/2") 13 mm
(1' - 11") 0.58 m	(3/4") 19 mm
(2' - 7") 0.80 m	(7/8") 22 mm
(3' - 5") 1.04 m	(1") 25 mm
(5' - 3") 1.60 m	(1 ¼") 32 mm

For spans greater than 5 feet-3 inches, a structural design shall be prepared by a California registered civil engineer.

PART 3 – EXECUTION

3.1 GENERAL

A. Where abandoned underground structures are encountered in the street areas, remove to sufficient depth to allow underground lines to cross, backfill and compact during rough grading. The ENGINEER may require further work to be done if visual inspection indicates during construction.

3.2 MINOR STRUCTURE EXCAVATION

A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown on the Drawings or ordered by the ENGINEER. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures required for the removal or exclusion of water, including storm water, groundwater, and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The limits of structure excavation shall be a minimum of 12 inches beyond the outside edge of the structure, and at a minimum no larger than necessary to facilitate backfill, compaction and testing operations. For structures poured against undisturbed soil the width of the structure wall shall be no more than 2 inches greater than specified or shown on the Drawings.

B. **Excavation Beneath Minor Structures**: Except where otherwise specified for a particular structure or as directed by the ENGINEER, excavation shall be carried to the grade of the bottom of the structure. When directed by the ENGINEER, areas beneath minor structures shall be over-excavated. When such over-excavation is directed, both over-excavation and subsequent backfill to the required grade shall be performed. After over-excavation is performed and before backfill is placed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 90 percent of maximum density.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

A. **Trench Width:** Unless otherwise shown or directed, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and larger, and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches. For deep trenches, the maximum width requirement may be waived for constructability reasons with the written approval of the ENGINEER. For telecommunications conduits (electrical, telephone, cable TV/communication conduits), street light and traffic signal conduits, the width of the trench shall be as shown on the City standard details.

B. **Subgrade:** The surface of the subgrade after compaction shall be hard, uniform, smooth, self draining, and true to grade and cross section.

C. **Trench Bottom:** The pipe bedding shall be given a final trim establishing grade such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Rounding out the trench bottom or bedding to form a cradle for the pipe will not be allowed. The CONTRACTOR shall excavate for bell holes and fittings.

D. **Open Trench:** The maximum amount of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed and backfilled in a single day. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate may be waived in cases where the trench is located further than 100 feet from any travelled roadway or occupied structure. In such cases, however, barricades and warning lights meeting safety requirements shall be provided and maintained.

E. **Trench Over-Excavation:** Where indicated trenches shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the Pipe Zone.

F. **Over-Excavation:** When ordered by the ENGINEER, whether or not indicated on the Drawings, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the Pipe Zone.

G. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level a minimum of 2 feet above the top of the pipe, as directed by the ENGINEER, or as recommended by the pipe manufacturer, whichever is greater, before the trench is excavated.

3.4 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

A. Any over-excavation carried below the grade ordered, specified, or shown, shall be backfilled to the required grade and densified with the specified material and compaction. Such work shall be performed by the CONTRACTOR at its own expense.

3.5 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, stockpiled, watered and preserved for replacement. Excavated material may be placed on the lawn provided that a tarp or other suitable method is employed to protect the lawn from damage. The lawn shall not remain stockpiled for more than 48 hours. Immediately after completion of backfilling and testing of the pipeline, the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod, in kind, if removed sod has remained stockpiled for more than 48 hours.

B. All other landscaping shall be replaced in kind in conformance with Section 329113, "Landscape Soil Preparation," and Section 329300, "Landscape Planting," as shown on the Drawings or as directed by the ENGINEER. All damaged irrigation systems, including piping and electrical wiring, shall be repaired and operating properly the same day they are damaged, in conformance with Section 328000, "Irrigation Systems."

3.6 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the ENGINEER. Trees shall be supported during excavation by any means previously reviewed by the ENGINEER.

B. If existing roots over one inch in diameter are cut during the course of the work, the cut faces shall be thoroughly coated with emulsified asphalt made especially for use on cut or damaged plant tissues. Exposed roots shall be covered with wet burlap to prevent them from drying out.

3.7 ROCK EXCAVATION

A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock.

B. **Explosives and Blasting:** Use of Explosives and Blasting will not be permitted.

3.8 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The CONTRACTOR shall remove and dispose of all excess excavated material to a suitable site. The proper and legal disposal shall be the responsibility of the CONTRACTOR.

3.9 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure for a minimum of 72 hours or until the concrete has attained sufficient design strength to withstand the loads imposed, whichever is greater.

B. Except for Product Type 3B material being placed in over-excavated areas or trenches and unless specifically excepted by the ENGINEER, backfill shall not be placed until after all water is removed from the excavation.

3.10 PIPE AND UTILITY TRENCH ZONES AND BACKFILL

A. **Pipe Zone and Backfill:**

1. The Pipe Zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 12 inches above the top surface of the pipe.

2. The Pipe Zone shall be backfilled with the specified backfill material. The CONTRACTOR shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.

B. **Bedding:** The bedding is defined as that portion of the Pipe Zone lying between a plane 6 inches below the bottom surface of the pipe, the trench subgrade, and a level line from the bottom of the pipe.

1. Bedding shall be provided for all pipelines.

2. After compacting the bedding the CONTRACTOR shall perform a final trim for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

C. **Trench Zone and Backfill:** After the Pipe Zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the Trench Zone may proceed.

The Trench Zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 24 inches below the roadway subgrade in paved areas, or 24 inches below the finished surface grade in landscaped or unimproved areas.

D. **Final Zone and Backfill:** The Final Zone is defined as the last 24 inches between the top of the Trench Zone and the roadway subgrade in paved areas, and the last 24 inches of the vertical trench cross-section lying between the top of the Trench Zone and the finish final grade in landscaped or unimproved areas.

E. **Utility Crossing:** For any new pipeline installation that crosses under an existing electric, gas, telephone, or cable tv utility pipe(s) or conduit(s) the CONTRACTOR shall replace the existing backfill material around the existing utility pipe(s) or conduit(s) with PG&E SAND. PG&E SAND shall be placed from a plane 6 inches below the bottom of the lowest utility pipe or conduit to a plane 12 inches above the top of the highest utility pipe or conduit, and for the full width of the new trench. PG&E SAND backfill shall be compacted to 95 percent maximum density in conformance with COMPACTION AND BACKFILL MATERIALS as specified below.

3.11 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in horizontal layers. The backfill layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.

B. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer and uniformity of moisture throughout backfill materials. Pipe Zone backfill materials shall be manually spread around the pipe so that when compacted the Pipe Zone backfill will provide uniform bearing and side support.

C. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried or replaced until the moisture content is satisfactory.

E. Backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type subject to review by the ENGINEER. Impact-type pavement breakers (stompers) will not be permitted. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or new improvements. The CONTRACTOR shall make its own determination in this regard.

F. Material for mechanically compacted backfill may be placed in loose lifts which, prior to compaction, shall not exceed the thickness specified below for various types of equipment:

1. Vibratory equipment, including vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers - maximum lift thickness of 2 feet.

2. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels - maximum lift thickness of 1 foot.

3. Hand-directed mechanical tampers-maximum lift thickness of 4 inches.

G. Mechanically compacted landfill shall be placed in horizontal layers of thickness not exceeding those specified above, compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened or dried, if necessary, and then tamped or rolled until the specified relative compaction has been attained.

3.12 COMPACTION OF BACKFILL MATERIALS

A. Each layer of backfill material as defined herein, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content range.

B. Flooding, ponding, or jetting shall not be used.

C. Equipment weighing more than 10,000 pounds shall not be used closer to structure walls than a horizontal distance equal to the depth of the fill against the structure wall at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

D. **Compaction Requirements:** The following compaction test requirements shall be in accordance with ASTM D 1557 for cohesive type materials and in accordance with ASTM D 4253 and D 4254 for "non-plastic" cohesionless free draining granular type materials. Where other agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density	Percentage of Relative Density
Pipe Zone backfill including bedding and overexcavated zone.	90	65
Final Zone backfill beneath paved areas or structures.	95	70

Final Zone backfill beneath unpaved access areas, landscape, or unimproved areas.	90	55
Trench Zone backfill.	90	65
Backfill beneath minor structures.	95	70
Backfill around minor structures.	90	65

Maximum Density refers to maximum dry density according to ASTM D 1557 laboratory test procedures. Percentage of Relative Density refers to ASTM D 4253 and ASTM D 4254 laboratory test procedures. Relative density should only be used for "non-plastic" cohesionless free draining, granular-type materials.

E. **Trench Backfill Requirements:** The pipe class has been structurally designed based upon the trench configuration previously specified herein.

1. The CONTRACTOR shall maintain the previously specified trench width up to a horizontal plane lying 12 inches above the top of the pipe.

2. If, at any location under said horizontal plane, the CONTRACTOR slopes the trench walls or exceeds the maximum trench widths indicated the Pipe Zone backfill shall be "improved" or the pipe class improved at no additional cost to the CITY. "Improved" backfill shall mean Control Low Strength Materials or other equivalent materials acceptable to the ENGINEER.

3. If the allowable deflection specified for the pipe is exceeded, the CONTRACTOR shall expose and reround or replace the pipe, repair all damaged lining and coating, and reinstall the Pipe Zone material and Trench Zone backfill as specified.

4. All trenches shall have a minimum of 2 inches of temporary asphalt placed daily and maintained unless final paving can be completed in the same day. Temporary asphalt shall be placed flush with adjacent pavement grade.

Steel plates may be used to cover open trenches in-lieu of backfill and temporary asphalt pavement.

3.13 STEEL PLATE

A. **General:** When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a work day, steel plate bridging with a non-skid surface and shoring may be required to preserve unobstructed traffic flow.

B. When steel plate bridging is required, the following conditions shall apply:

1. Steel plates used for bridging must extend a minimum of 12 inches beyond the edges of the trench.

2. Steel plate bridging shall be installed to operate with minimum noise.

3. The trench shall be adequately shored to support the bridging and traffic loads.

4. Temporary paving with cold asphalt concrete shall be used to feather the edges of the plates, if plate installation by Method (2) is used.

5. Bridging shall be secured against displacement by using adjustable cleats, shims or other devices.

C. Steel plate bridging and shoring shall be installed using either Method (1) or (2):

1. Method 1 For speeds more than 45 mph:

   The pavement shall be cold planed to a depth equal of the thickness of the plate and to a width and length equal to the dimensions of the plate.

2. Method 2 For speeds 45 mph or less:

   Approaching plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates are butted to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope 8.5 percent with a minimum 12 inch taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry or an equivalent slurry.

D. Steel plate bridging should not exceed 4 consecutive working days in any given week.

- END OF SECTION -

SECTION 312323 - CONTROLLED LOW STRENGTH MATERIALS (CLSM)

PART 1 – GENERAL

1.1 REQUIREMENTS

A. Controlled Low Strength Materials (CLSM) will be allowed only on a case-by-case basis with the written approval of the ENGINEER.

b. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place CLSM, complete in place, and shall mix, place, finish, and do all other work to produce a cementitious hand excavatable mixture of aggregate, cement, pozzolan, water, and admixtures to be used as backfill or pipe abandonment fill, as shown on the Drawings and as specified herein.

C. The CONTRACTOR is hereby advised that flotation or displacement of the pipe may occur during installation of the CLSM. The CONTRACTOR shall make necessary provisions to ensure that the pipe is installed according to the alignment and grade specified on the Drawings. Any pipe that is floated shall be removed and replaced at the CONTRACTOR'S expense.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ACI 229	Controlled Low Strength Materials.
ACI 232	Fly Ash/Other Pozzolans in Concrete.
ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 94	Specification for Ready-mixed Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Additive in Portland Cement Concrete.
ASTM D 1586	Method for Penetration Test and Split Barrel Sampling of Soils.

ASTM D 1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow-Depth).
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow-Depth).

1.4 CONTRACTOR SUBMITTALS

A. **Mix Design**: Prior to beginning any work the CONTRACTOR shall submit to the ENGINEER for review, the pre-approved CLSM mix designs which shall show the proportions and gradations of all materials proposed for each class and type of CLSM to be used.

B. **Certificate of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIALS (CLSM)

A. **General:**

1. CLSM shall be a flowable, hand-excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94.

2. **Composition:** The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.

   a. Mix proportions shall be as approved.

   b. Entrained air content shall be between 8 percent minimum and 20 percent maximum.

   c. Water reducing agent content shall be as approved.

3. **Properties:**

   a. Density shall be between 120 PCF minimum and 135 PCF maximum.

   b. Slump shall be as approved.

   c. Compressive strength at 28 days for flowable CLSM shall be between 50 psi minimum and 150 psi maximum.

B. **Cement:** Cement shall be Type II in accordance with the requirements of ASTM C 150.

C. **Pozzolan:** Pozzolan shall be added to improve the flowability and shall be Type F in accordance with the requirements of ASTM C 618.

D. **Aggregate:** Coarse aggregate shall consist of a well graded mixture of crushed rock, soil, or sand with a maximum size aggregate of ½ inch. 100 percent shall pass the 3/4 inch sieve. Not more than 30 percent shall be retained by the 3/8 inch sieve and not more than 12 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of the WORK.

E. **Admixtures:**

1. Air entraining shall be added to improve the workability and shall be in accordance with the requirements of ASTM C 260.

F. **Water:** Water shall be clean and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.

G. **Controlled Low Strength Materials (CLSM):**

1. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water batched by a ready mix concrete plant and delivered to the WORK by means of standard transit mixing trucks. The mixture shall produce a cementitious, flowable, hand excavatable material.

2. The actual mix proportion and slump shall be as determined by the approved mix design.

3. The entrained air content shall be a minimum of 8 percent and a maximum of 20 percent as required by the CONTRACTOR to meet the uses specified herein.

PART 3 – EXECUTION

3.1 TESTING

A. All testing during the work will be done by a testing laboratory of the CITY'S choice at the CITY'S expense except as otherwise noted.

B. In case the tests of the CLSM show non-compliance with the specifications the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the CITY and shall be at the CONTRACTOR'S expense.

C. **Density:** The installed density of the material will be determined in accordance with ASTM D 2922.

D. **Compressive Strength:** The compressive strength will be determined in accordance with ASTM C 39.

3.2 PREPARING PLACEMENT FOR CLSM

A. The trench subgrade or compacted fill to receive CLSM shall be complete and acceptable in accordance with Section 312300, "Utility Earthwork."

3.3 DELIVERING CLSM

A. CLSM shall be delivered to the WORK in standard transit mix trucks.

3.4 PLACING CLSM

A. CLSM shall be delivered in place by means of tailgate discharge, conveyor belts, pumped in place, or other means acceptable to the ENGINEER.

B. CLSM shall be directed in place by means of a vibrator, shovel or rod to ensure that all voids, crevices, and pockets are filled with CLSM. Care shall be taken to avoid over-consolidation of the material separating the large and fine aggregate.

C. CLSM shall be continuously placed against undisturbed in-situ earth material unless otherwise approved by the ENGINEER. Where new CLSM must be placed against existing CLSM, the placement shall be clean of all loose and foreign material. The surface of existing CLSM shall be soaked a minimum of one hour before placement of fresh CLSM. No standing water will be allowed before starting placement of fresh CLSM.

D. When placing CLSM for trench plugs (trench dams), the CONTRACTOR shall ensure that no voids exist around the pipe barrel and that the CLSM completely fills the trench width, including keyways, for the full depth required, as shown on the Drawings.

3.5 PROTECTING CLSM

A. CLSM shall be protected from running water, rain, freezing or other conditions that could damage the material until the material has been accepted and final fill complete.

B. No equipment, traffic, or backfill shall be allowed on the CLSM until the surface of the CLSM is able to withstand a 20 psi load without displacement or damage. If necessary, the CONTRACTOR shall provide steel trench plates that span the trench, as specified in Section 312300, "Utility Earthwork," until the CLSM has reached the required strength.

3.6 CURING

A. CLSM shall be kept damp for a minimum of 7 days or until final fill is completed.

- END OF SECTION -

SECTION 321000

ASPHALT PAVEMENT, BASE AND SURFACE TREATMENTS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and construct the roadway structural section, base repair, asphalt overlay, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1. Preparation of Subgrade.
2. Aggregate Subbase.
3. Aggregate Base.
4. Tack Coat.
5. Asphalt Concrete Base Repair.
6. Pavement Crack Sealant.
7. Remove and Replace Traffic Markings.
8. Pavement Grinding.
9. Pavement Pulverization and Reshaping & Compaction of Base Material.
10. Sawcutting.
11. Pavement Reinforcing Fabric.
12. Pavement Reinforcing Mesh
13. Asphalt Concrete Overlay, Utility Cut Pavement Replacement, and Pavement Structural Section.
14. Adjust Iron Castings to Grade.
15. Pavement Flood Testing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 311300	Selective Tree and Vegetation Trimming and Removal.
B. Section 311316	Root Pruning.
C. Section 310000	Earthwork.
D. Section 312300	Utility Earthwork.
E. Section 333900	Precast Concrete Maintenance Holes.
F. Section 311723	Traffic Stripes and Pavement Markings.
G. Section 321300	Concrete Surface Improvements
H. Section 022100	Monuments.
I. Section 055000	Miscellaneous Metal Work
J. Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards**

1. Standard Specifications:

Section 15	Existing Highway Facilities.
Section 19	Earthwork.
Section 25	Aggregate Subbases.
Section 26	Aggregate Bases.
Section 37	Bituminous Seals.
Section 39	Asphalt Concrete.
Section 42	Groove and Grind Pavement.
Section 84	Traffic Stripes and Pavement Markings.
Section 85	Pavement Markers.
Section 88	Engineering Fabrics.
Section 92	Asphalts.
Section 93	Liquid Asphalts.
Section 94	Asphaltic Emulsions.

B. **Commercial Standards:**

ASTM D 36	Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus.)
ASTM D 276	Test Method for Melting Point of High Strength Open Fiber Glass Mesh.
ASTM D 1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
ASTM D 3407	Methods of Testing Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.
G.R.I. GGI-87	Methods of Testing High Strength Open Fiber Glass Mesh for Tensile Strength and Maximum Elongation at Break.
D 5261-92	Method for Determining Minimum Mass/Unit Area of Open Fiber Glass Mesh.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. **Delivery Tickets:** For City public works projects, the CONTRACTOR shall provide delivery tickets to the ENGINEER at the time of delivery of each load of product, including aggregate subbase, aggregate base, asphalt concrete, liquid asphalt, sealant, and paving reinforcement fabric. Each delivery ticket shall include or be accompanied by appropriate batch information produced by the batching plant or factory of origin and information stating the mix or model number, total yield in kilograms, liters, or square meters, and time, date, and location of delivery.

1.5 QUALITY ASSURANCE

A. The CITY will employ a testing laboratory to perform all quality assurance testing and inspection testing as may be required by this Section.

B. At the discretion of the ENGINEER the CONTRACTOR shall flood test all asphalt pavement for proper drainage by flooding with water in ample quantity to demonstrate the correct shaping of the pavement.

PART 2 -- PRODUCTS

2.1 AGGREGATE SUBBASE

A. Aggregate subbase material shall be the class specified on the Drawings and shall be in conformance with Section 25, "Aggregate Subbases," of the Caltrans Standard Specifications.

2.2 AGGREGATE BASE

A. Aggregate base material shall be Class 2 aggregate base in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications. All aggregate base used on the work shall conform to the 19 millimeter maximum size gradations.

2.3 TACK COAT OR PAINT BINDER

A. A tack coat or paint binder shall be SS-1 asphalt emulsion in conformance with Section 39, "Asphalt Concrete," of Caltrans Standard Specifications.

B. A tack coat or paint binder to be used with pavement fabric or mesh shall be asphalt grade AR-8000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

2.4 ASPHALT CONCRETE BASE REPAIR

A. Asphalt concrete for base repair shall be Type A for all City streets.

B. The asphalt binder shall be paving asphalt Grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

C. The aggregate shall be 19 millimeter maximum size, medium grading, in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

2.5 PAVEMENT CRACK SEALANT

A. The pavement crack sealant shall be a modified asphalt composition conforming to the following requirements:

Test	Test Method	Requirements
Softening Point	ASTM D 36	180-degree F. minimum
Core Penetration at 77-degrees F.	ASTM D 3407	30-dmm minimum
Resilience at 77-degrees F.	ASTM D 3407	30 percent minimum
Flow	ASTM D 3407	3-mm maximum

B. If asphalt ground rubber is used, the gradation of the asphalt ground rubber shall be such that 100 percent will pass a No. 8 sieve.

C. The material shall be capable of being melted and applied to cracks and joints at temperatures below 400-degrees F. When heated, it shall readily penetrate cracks 1/4-inch wide or wider.

2.6 PAVEMENT REINFORCING FABRIC / CRACK-RETARDING MASTIC MEMBRANE AND PAVEMENT REINFORCING MESH

A. Pavement reinforcing fabric shall be a non-woven material designed as a pavement reinforcing fabric in conformance with Section 88, "Engineering Fabrics," of the Caltrans Standard Specifications.

B. Crack-retarding mastic membrane is intended as a stress relieving interlayer to control development of reflective cracking from occurring in the overlay of isolated areas of moderate to severe surface cracking. It may include an adhesive backing and release liner. Crack-retarding mastic membrane shall be as manufactured by **Pavetech International. - Paveprep, Paveprep SA , and AMOCO Fabrics and Fibers Company - Petrotac or equal.**

C. Pavement reinforcing mesh shall be a high strength glass fiber grid designed for reinforcing wider overlay areas with tensile resistance against pavement fatigue created by higher traffic loading and to prevent reflective cracking by relieving stresses as either an underlayment or an interlayer. It usually requires a self-tacking adhesive for installation or may be specified as a composite with a waterproofing membrane or nonwoven fabric layer.

The pavement reinforcing mesh shall be a knitted, glass fiber strand grid with the following minimum characteristics, or an equal material, as determined and approved by the ENGINEER.

Test	**Test Method**	**Requirements**
Tensile Strength	G.R.I. GG 1-87	560 lbs/in. (100 kN/m) Component strand strength
Elongation at Break	G.R.I. GG 1-87	5 Percent Maximum
Melting Point	ASTM D 276	425 deg.-F (218 deg.-Celsius)
Mass/Unit Area	D 5261-92	11 oz./sq. yd. (370 g/m2)

All values represent certifiable average minimum roll values in the weakest principal direction of the grid. The manufacturer shall supply test data to the ENGINEER for review prior to the start of mesh placement. Data shall be signed by the responsible quality assurance principal at the manufacturing facility and be representative of all of the product used on the project.

2.7 ASPHALT CONCRETE OVERLAY, UTILITY CUT PAVEMENT REPLACEMENT, AND PAVEMENT STRUCTURAL SECTION

A. Asphalt concrete shall be Type A on all City streets.

B. Asphalt concrete shall be placed at the thickness indicated on the Drawings.

C. The asphalt binder shall be paving asphalt grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

D. The aggregate shall be 12.5 millimeter maximum size, medium grading for overlays and top lift(s) of pavement structural sections in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications. The minimum overlay thickness for the top lift shall be 1.5 inches (38 mm). The aggregate shall be 19 millimeter maximum size, medium grading, for the bottom lift(s) of pavement structural sections in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications. For pavement structural sections less than 4 inches (102 mm), the aggregate shall be 12.5 millimeter maximum size, medium grading in accordance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

2.8 FINE ASPHALT CONCRETE PAVING

A. Fine asphalt concrete for patch paving shall be Type B, 9.5 millimeter maximum size. The asphalt binder shall be paving asphalt grade AR-4000 in conformance with Section 92, "Asphalts," of the Caltrans Standard Specifications.

2.9 PORTLAND CEMENT CONCRETE

A. Portland Cement Concrete used to adjust utility structure frames and monument frames to grade shall be Class B in conformance with Section 033050, "Utility Cast-in-Place Concrete."

2.10 IRON CASTINGS AND COVERS

A. The CONTRACTOR shall provide new iron castings in accordance with Section 055000 "Miscellaneous Metal Work" and the City Standard Details when required by the ENGINEER.

PART 3 – EXECUTION

3.1 GENERAL

All work adjacent to existing pavement structural section shall butt up to the full existing structural section. Where the full pavement structural section is not encountered, continue removal of additional pavement structural section until a full pavement structural section is found.

3.2 ORDER OF WORK

A. Selective tree and vegetation trimming and/or root pruning operations necessary for work requiring equipment accessibility or installation of improvements shall be completed prior to commencement of that work.

B. All underground utilities shall be installed, inspected and approved, and all backfill and compaction operations shall be completed prior to commencement of pavement structural section construction.

C. Cutting or patching of finished pavement will not be allowed.

3.3 PREPARATION OF SUBGRADE

A. The subgrade shall be prepared in conformance with Section 19, "Earthwork," of the Caltrans Standard Specifications, unless modified by this Section.

B. Subgrade preparation shall extend a minimum of 2 feet beyond all concrete improvements and asphalt paved areas. Unless otherwise recommended in the soils report, the subgrade shall be scarified to a minimum depth of 6 inches below the grading plane, mixed thoroughly and wetted in conformance with ASTM D 1557, or dried as directed by the ENGINEER. The pavement section, the entire area under the curb and gutter, bus turnout area, and the area 2 feet beyond any edge of pavement without abutting concrete improvements shall be thoroughly compacted to not less than 95 percent relative compaction in conformance with ASTM D 1557. Compaction of subgrade under sidewalk, access ramps, driveways, median surfacing and the area 2 feet beyond any concrete improvements shall be thoroughly compacted to not less than 90 percent relative compaction in conformance with ASTM D 1557. The surface of the subgrade after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

C. All soft material which will not compact readily and all unstable material shall be removed in conformance with the Section entitled "Roadway Excavation," in PART 3 of Section 310000, "Earthwork." All materials for subgrade replacement shall be in conformance with the written recommendations of the Geotechnical Engineer.

D. Subgrade preparation and compaction and determination of subgrade stability shall performed under the observation of the ENGINEER. In no case shall lime or cement treatment be used to stabilize subgrade.

E. Finish subgrade shall be within the tolerances established in Section 19-1.03, "Grade Tolerances," of the Caltrans Standard Specifications.

3.4 AGGREGATE SUBBASE

A. Aggregate subbase shall be spread and compacted in conformance with Section 25, "Aggregate Subbases," of the Caltrans Standard Specifications unless modified by this Section. Finished aggregate subbase shall have a minimum thickness as shown on the Drawings and shall not vary more than 0.08 foot above or below the established grade. The aggregate subbase shall be compacted to 95 percent relative compaction in conformance with ASTM D 1557. The surface of the aggregate subbase after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

3.5 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with Section 26, "Aggregate Bases," of the Caltrans Standard Specifications for Class 2 Aggregate Base. Finished aggregate base shall have the minimum thickness as shown on the Drawings and shall not vary more than 0.05 foot above or below the established grade. The aggregate base shall be compacted to 95 percent relative compaction in conformance with ASTM D 1557. The surface of the aggregate base after compaction shall be hard, unyielding, uniform, smooth, self-draining, and true to grade and cross-section.

3.6 TACK COAT

A. The CONTRACTOR shall be responsible for the proper use of tack coats and shall be in conformance with applicable regulatory requirements.

B. Tack Coat or Paint Binder

Prior to placement of asphalt concrete a tack coat or paint binder shall be applied to existing paved and vertical surfaces where new asphalt concrete is to be placed on or against existing pavement at

an approximate total rate from 0.02 gallon to 0.10 gallon per square yard to all areas receiving asphalt concrete. The exact rate of application will be determined by the ENGINEER. Care shall be taken to prevent over application of tack coat material onto finish surfaces that will not be in contact with the new asphalt concrete pavement.

3.7 ASPHALT CONCRETE BASE REPAIR

A. Existing failed roadway sections shall be excavated to the limits as marked in the field and/or as shown on the Drawings. During base repair operations streets shall not be closed to traffic, but temporary traffic controls shall be implemented in conformance with the Division 1, General Requirements.

B. The CONTRACTOR shall not excavate more area than he is capable of paving within the same working day. At the end of each working day all open street excavations must be either backfilled and compacted to within one inch below existing finish grade, or covered with steel plating in conformance with Section 312300, "Utility Earthwork" in order to allow use by public traffic.

C. On residential streets, excluding truck routes and bus routes, requiring an asphalt concrete overlay, a minimum depth of 4 inches of pavement structural section shall be cut out, removed and replaced with asphalt concrete. On residential streets, excluding bus routes, not requiring an asphalt concrete overlay a minimum depth of 6 inches of structural pavement section shall be cut out, removed and replaced with asphalt concrete.

On all other streets, including truck routes and bus routes, the depth of removal of the pavement structural section shall be as shown on the Drawings or as determined by the ENGINEER.

Where soft or unsuitable materials are encountered, additional excavation and/or remediation will be required as determined by the ENGINEER.

D. For CITY owned traffic signals where traffic signal detector loops are present, the CONTRACTOR shall notify the ENGINEER a minimum of 48 hours prior to beginning asphalt concrete base repair work. For Caltrans traffic signals the CONTRACTOR shall notify Caltrans in conformance with Caltrans requirements.

E. **Cutting of Existing Pavement Structural Section:** All final cuts in asphalt concrete shall be straight, clean, and vertical for the full depth of the cut. Additional areas shall be cut out when determined by the ENGINEER that the edge of the asphalt concrete pavement to remain is loose, depressed, or potentially unstable. Cutting of the existing pavement structural section shall be done by one of the following options:

1. Longitudinal cuts may be wheel-cut but shall be discontinued if the ENGINEER determines that excessive breakage or deflection of the adjacent pavement to remain is occurring.

2. On streets that are to receive an asphalt concrete overlay as a part of the work a jack-hammer, sawcutter or grinder may be used.

3. All other cuts shall be made by saw-cutting or grinding.

F. The asphalt concrete material removed shall become the property of the CONTRACTOR and shall be disposed of in a legal manner.

G. After removal of the asphalt concrete, the existing base or subgrade shall be shaped to conform to the cross slope or crown of the street, and a minimum of the top 6 inches re-compacted to 95 percent relative compaction in conformance with ASTM D 1557.

H. The vertical edges of the excavated paving repair area shall be treated with a tack coat. Care shall be taken to prevent over application of the tack coat material onto finish surfaces that will not be in contact with the new asphalt concrete pavement.

I. Asphalt concrete for pavement repair sections shall be placed in a minimum of 2 lifts and shall be spread and compacted in the number of layers and thicknesses in conformance with Section 39-6.01, "Spreading and Compacting," of the Caltrans Standard Specifications.

J. The finish grade of the new asphalt concrete pavement shall be flush with the adjacent existing pavement and shall conform to cross slope or crown of the street. Variances of more than zero to 1/8 inch above the existing pavement grade will not be allowed. Asphalt concrete base repairs that are out of tolerance with existing pavement shall be ground down or removed and repaved.

3.8 PAVEMENT CRACK SEALING

A. Prior to overlaying existing pavements, crack sealing operations shall be performed in accordance with the following:

1. Crack sealing shall be performed on all pavement cracks ¼-inch wide or wider. Cracks between a ¼-inch and a ½-inch wide shall be routed to a depth and width of ½-inch prior to sealing.

2. Crack sealing shall be performed after any required pavement repair or grinding operations and prior to placing flexible pavement coatings, pavement reinforcing fabric, or overlay.

3. All pavement cracks not routed shall first be treated with a liquid herbicide product.

4. Immediately prior to performing crack sealing, the cracks shall be cleaned by the use of high-pressure compressed air such that all vegetation, dirt, and other objectionable materials are removed. The compressed air shall be filtered of moisture and oils. Under damp conditions, a hot compressed air lance shall be utilized to dry the cracks as well.

5. Sealant material shall conform to the provisions of PART 2 "Products" of this Section and shall be applied at the temperature and rate recommended by the manufacturer.

6. Sealant shall be applied to a slightly overfilled condition, then struck off with a guide-shoe, plate, or squeegee to produce a band of material 2 inches to 4 inches in width, centered over the crack. On streets to be slurry or seal-coated, strike-off height shall be less than 1/8-inch above the pavement surface.

7. Extensively cracked pavement areas shall not be crack sealed unless specifically directed by the ENGINEER. This is necessary to avoid interference with proper adhesion of the flexible pavement coatings, pavement reinforcing fabric, or overlay, and to avoid subsequent asphalt bleeding on the new surface. Where the ENGINEER determines excessive coating or thickness of pavement crack sealant by the CONTRACTOR, the CONTRACTOR shall perform the necessary pavement base repairs to correct the problem prior to placement of any flexible pavement coating, pavement reinforcing fabric, or overlay.

8. Crack seal areas shall be protected from traffic until the material has sufficiently cured and does not track. Any damage or loss of material from freshly placed crack seal material shall be replaced by the CONTRACTOR .

3.9 REMOVE AND REPLACE TRAFFIC MARKINGS

A. Removal and replacement of existing traffic striping, legends, and pavement markers shall be in conformance with Section 02760, "Traffic Stripes and Pavement Markings."

B. Removal and replacement of traffic striping, legends, and raised pavement markers shall conform to the following scheduling requirements:

1. Existing traffic striping, legends, and pavement markers shall be completely removed prior to beginning of resurfacing operations. The CONTRACTOR shall then either begin said operations within 24 hours of the removal of the existing delineations or shall replace said delineations with painted markings.

2. Permanent traffic striping, legends, and pavement markers shall be installed no sooner that 2 calendar days nor later than 7 calendar days after the resurfacing has been placed. Raised pavement markers shall be installed no sooner than 7 calendar days no later than 14 calendar days after resurfacing has been placed. Traffic striping, legends, and pavement markers shall be installed in conformance with Section 84, " Traffic Stripes and Pavement Markings," and Section 85, "Pavement Markers," of the Caltrans Standard Specifications. The layout of permanent traffic striping, legends, and pavement markers shall be approved in writing by the ENGINEER prior to installation.

3.10 PAVEMENT GRINDING

A. Grinding necessary to perform edge and transverse pavement conforms shall be performed on all streets to be overlaid and shall be completed in conformance with Section 42-2, "Grinding," of the Caltrans Standard Specifications and this Section.

B. Grinding at curbs, gutters, valley gutters, and street intersections shall be in conformance with the Drawings and Standard Details. No grinding shall be performed through an intersection if the cross street is also to be overlaid.

C. Damage to detector loops at CITY owned traffic signals shall be reported to the ENGINEER and repaired by the CONTRACTOR at its own expense within 24 hours of disruption of service. If the CONTRACTOR fails to repair damaged loops within the specified time the CITY will repair the damage at the CONTRACTOR'S expense. Damage to detector loops at traffic signals owned by other Agencies shall be repaired in conformance with the appropriate Agency requirements.

D. All materials removed shall become the property of the CONTRACTOR and shall be disposed of in a legal manner. Residue from the grinding operations may be removed from the roadbed by a vacuum sweeper following within 50 feet of the grinding operations. The CONTRACTOR shall be responsible for maintaining the street in a clean condition during the course of the grinding operations. All loose materials shall be removed prior to the application of the tack coat.

E. Areas that cannot be reached with the grinding machine shall be jack-hammered or otherwise removed by hand.

F. When grinding operations proceed pavement overlay operations by more than 3 calendar days and/or the grinding exceeds 2 inches, the CONTRACTOR shall place temporary asphalt concrete ramps at all grinding limits which abut remaining asphalt pavement surfaces. Temporary asphalt concrete ramps shall be in place the same day as the grinding operation.

G. Temporary asphalt concrete ramps shall be a minimum of 5 feet in length, extending the entire width of the affected travelway, and shall be sufficiently compacted so as not to deform or ravel.

H. The CONTRACTOR shall maintain temporary asphalt concrete ramps to the satisfaction of the ENGINEER and shall completely remove them prior to the application of tack coat.

3.11 SAWCUTTING FOR ROADWAY WIDENING

A. When removing asphalt pavement in connection with roadway widening the existing asphalt pavement shall be sawcut with a power driven asphalt saw to provide a smooth joint for the new pavement. The CONTRACTOR shall sawcut the pavement before any pavement excavation to avoid damage to the pavement section to remain.

3.12 PAVEMENT PULVERIZATION AND RESHAPING & COMPACTION OF BASE MATERIAL

A. On public works projects when specifically required on the Drawings, the CONTRACTOR shall pulverize the existing pavement to the limits shown on the Drawings, or as otherwise directed by the ENGINEER, using specialized mechanized equipment capable of pulverizing asphalt concrete into a uniform gradation of not more than 1-1/2 inch maximum size. The equipment shall also be capable of capturing and containing airborne dust particles in an appropriate manner as to conform to the dust abatement requirements of the Specifications.

B. The CONTRACTOR shall pulverize the existing pavement until the maximum size of the asphalt concrete is not more than 1-1/4 to 1-1/2 inches and mix it with the underlying top two inches of base material.

C. The CONTRACTOR shall reshape and compact the combined mixture as a new base for the thickness of asphalt concrete shown on the Drawings. The street section shall be reshaped to a cross-slope of 2.0% minimum to 5.0% maximum as approved by the ENGINEER. The CONTRACTOR shall compact the base to a minimum relative compaction of 95% with a two-axle steel drum roller weighing not less than eight tons nor more than ten tons. Compaction will be determined from a moisture-density curve performed on the mixed material to determine the optimum moisture for compaction.

D. Should pulverization operations produce an excess of material which cannot be reshaped and compacted to meet the necessary cross-slope, the excess material shall become the property of the CONTRACTOR and shall be disposed of in a legal manner.

E. The CONTRACTOR shall be responsible for maintaining the street in a clean condition during the course of the pulverization operations. Surrounding traffic and pedestrian areas shall be swept and maintained free of loose material and debris at all times and residue from the pulverization operations shall be removed from the surrounding improvements by the end of the work day.

F. Areas that cannot be reached with the pulverization machine shall be jack-hammered or otherwise removed by hand.

G. Pulverization operations shall not precede pavement overlay operations by more than three calendar days, unless otherwise approved in writing by the ENGINEER.

H. The CONTRACTOR shall place temporary asphalt concrete ramps at all pulverization limits which are to conform to remaining asphalt pavement surfaces. Temporary asphalt concrete ramps shall be in place the same day as the pulverization operation.

I. Temporary asphalt concrete ramps shall be a minimum of 5 feet in length, extending the entire width of the affected travelway, and shall be sufficiently compacted so as not to deform or ravel.

J. The CONTRACTOR shall maintain temporary asphalt concrete ramps to the satisfaction of the ENGINEER and shall completely remove them prior to the application of tack coat.

3.13 PAVEMENT REINFORCING FABRIC / CRACK-RETARDING MASTIC MEMBRANE

A. Placement of pavement reinforcing fabric and mastic membrane, including application of tack coat shall be in conformance with Section 39-4, "Subgrade, Prime Coat, Paint Binder (Tack Coat), and Pavement Reinforcing Fabric," and Section 88, "Engineering Fabrics," of the Caltrans Standard Specifications and this Section.

B. Prior to placement of tack coat, fabric or mastic membrane, the CONTRACTOR shall insure that the existing pavement is clean and free of dirt, water, and vegetation. All cracks shall be cleaned and if necessary, sealed in conformance with this Section. Care shall be taken to prevent the application of tack coat material to surfaces that will not be in contact with the new asphalt concrete pavement.

C. Placement of pavement reinforcing mesh shall be in conformance with the manufacturer's recommendations as approved by the ENGINEER and this Section. The surface temperature before laying the mesh shall be between 40 degrees F (5 degrees C) and 140 degrees F (60 degrees C.)

D. Prior to placing pavement reinforcing mesh, the existing pavement shall be cleaned to provide an adequate surface for the adhesion of the mesh to the satisfaction of the ENGINEER and/or manufacturer's representative. The pavement shall be cleaned by sweeping or vacuuming and be free of oil, vegetation, sand, dirt, water, gravel, debris, paint, pavement markers, striping, or rubber, including loose aggregate and fines from level course or finish paving operations.

   All cracks shall be cleaned, and if necessary, sealed in conformance with this Section. For direct application of pavement reinforcing mesh on an existing pavement, cracks ¼-inch and larger shall be filled with crack sealer per this Section. Potholes shall be dug out and filled with hot mix to provide a level surface. Areas with uneven surfaces and/or extensive cracking shall require a leveling course as determined by the ENGINEER.

E. Tack Coat shall be applied by a suitably metered truck with all spray heads adequately adjusted to lay down an even coat. Tack coating for pavement reinforcing fabric or mastic membrane shall be applied per the manufacturer's recommendations. Mastic membrane with self-adhesive backing may be used without tack coat in accordance with the manufacturer's recommendations. Tack coating is not usually required for pavement reinforcing mesh and shall only be applied when recommended by the manufacturer for the specific work. In this application, emulsion type tack coating must be cured before placement of the reinforcing mesh.

F. Fabric placement equipment shall be mechanized and shall be capable of handling full rolls of material and of laying the fabric without forming excessive wrinkles and/or folds in conformance with the manufacturer's recommendations for installation. Manually laying the fabric shall only be allowed in small areas not practical for mechanical equipment.

G. Mesh laid by mechanical means or by hand must be under sufficient tension to eliminate ripples. Should ripples occur, these must be removed by pulling the grid tight or in extreme cases, by cutting to the manufacturer's recommendations and lying it flat. Transverse joints shall be lapped in the direction of the paver by a minimum of 4 inches. Longitudinal joints shall be 1-2 inches overlapped.

H. Fabric or mesh shall not be placed within the grinding limits unless placed on a level course first or as otherwise directed by the ENGINEER. Normally mesh placement shall end one foot before the grind at pavement conforms and one foot before vertical butt transitions.

I. Mastic membrane shall be rolled with a static drum roller or rubber tire pneumatic roller or as recommended by the manufacturer.

J. Pavement reinforcing mesh shall be rolled with a rubber coated roller or pneumatic tire roller, to activate the self-adhesive. Tires must be clean to avoid pick up of the mesh. A pneumatic tire roller or tractor installer with pneumatic tire roller assembly shall adhere the mesh to the surface. A vehicle with rubber tires may be used to adhere reinforcing mesh to existing surface if approved by the manufacturer. The CONTRACTOR shall not pave if adequate adhesion is not achieved first.

K. The CONTRACTOR shall neatly cut the reinforcing material around all utility structures and monuments prior to placing pavement overlay.

L. Construction and emergency vehicles may run across the reinforcing material after being rolled with the insurance that precautions are taken to avoid damage caused by turning and braking. The material must also be kept clean of mud, dust and debris. Damaged sections shall be removed and patched to the manufacturer's printed recommendations, taking care to completely cover the damaged area.

M. In areas of localized bleeding of tack coat through the fabric, the CONTRACTOR shall spread asphalt concrete over the area to prevent pick-up or lifting of the fabric.

N. The CONTRACTOR shall not place more fabric, mastic or mesh than can be covered with a minimum of 1-1/2 inches of hot asphalt concrete mix and compacted on the same working day.

O. All Pavement fabric, mastic, or mesh shall be stored, as per the manufacturer's recommendations, in a dry covered condition free from dust, dirt, and moisture.

3.14 ASPHALT CONCRETE OVERLAY OR PAVEMENT STRUCTURAL SECTION

A. Surface preparation for asphalt concrete overlay on existing asphalt concrete surfaces shall include removal of all traffic striping and legends, raised pavement markers, and all grinding, patching, and sweeping.

B. Application of a prime coat and/or tack coat shall not occur until all surface preparation has been performed.

C. Asphalt concrete shall be spread and compacted on the prepared base or existing asphalt concrete in conformance with the lines, grades and dimensions shown on the Drawings and in conformance with Section 39, "Asphalt Concrete," of the Caltrans Standard Specifications.

D. Spreading and compaction equipment and methods shall be in conformance with Sections 39-5,, "Spreading and Compacting Equipment," and 39-6, "Spreading and Compacting," of the Caltrans Standard Specifications and this Section. The ENGINEER may, at its option, call for continuous and/or random testing of asphalt concrete compaction. Asphalt concrete shall not be placed or stockpiled in windrows when the underlying layer or surface is frozen, or when, in the opinion of the ENGINEER, weather conditions will prevent the proper handling, finishing, or compaction of the asphalt concrete.

Spreading by blading equipment consisting of motor graders will not be allowed unless approved in writing by the ENGINEER.

E. The finished grade shall be flush with the adjacent existing pavement, shall conform to the cross slope or crown of the street, and shall be within the tolerances of the "straightedge" test as defined in Section 39-6.03, "Compacting," of the Caltrans Standard Specifications. The CONTRACTOR shall be responsible for all damage to fresh surfacing until it is ready for use by public traffic. Damaged areas shall be repaired to the satisfaction of the ENGINEER.

F. Asphalt concrete for new pavement structural sections shall be placed in a minimum of 2 lifts and shall be spread and compacted in the number of layers and thicknesses in conformance with Section 39-6.01, "Spreading and Compacting," of the Caltrans Standard Specifications.

G. The depositing, distribution, and spreading of each lift of the asphalt concrete shall be accomplished in a single, continuous operation.

H. All utility structures and monuments shall be marked for reference in at least 2 directions by the CONTRACTOR prior to placing the asphalt concrete. Said reference marking shall be made using a temporary removable water based marking chalk. The CONTRACTOR shall be responsible for the complete removal of all such reference markings after the completion of raising utility structures and monuments to grade.

I. Fog sealing of new asphalt concrete structural sections will not be allowed.

3.15 ASPHALT CONCRETE UTILITY CUT PAVEMENT REPLACEMENT

A. **Preparation of Existing Asphalt Concrete Pavement:** The existing asphalt concrete pavement shall be sawcut 12 inches past the edge of the trench to provide a smooth joint for the new pavement. The CONTRACTOR may sawcut the pavement before excavating the trench to facilitate the removal of the pavement. In addition the CONTRACTOR shall sawcut and remove any irregular or damaged pavement along the open trench as directed by the ENGINEER before placing new asphalt concrete pavement.

B. Placement of asphalt concrete shall be in conformance with this Section, except that the number of layers and thicknesses shall be as shown on the Drawings.

3.16 ADJUST IRON CASTINGS TO GRADE

A. All Iron Castings shall be set to finish grade after placing the asphalt concrete. The adjustment of structures and monuments to grade shall be in conformance with Section 15-2, "Miscellaneous Highway Facilities," of the Caltrans Standard Specifications and this Section.

B. Adjustment rings will not be allowed.

C. When streets are overlayed unless deemed unsuitable by the ENGINEER, existing frames and covers shall be salvaged and re-used. All iron castings damaged during construction shall be replaced by the CONTRACTOR with new iron castings at the CONTRACTOR'S expense. Replacement iron castings for CITY utility structures shall be replaced in conformance with the appropriate technical section. Replacement iron castings for other Agency utility structures shall be replaced in conformance with the appropriate Agency requirements.

D. All water valve covers shall be exposed on the same day in which they are covered by resurfacing operations.

E. All maintenance hole covers shall be raised no later than 5 working days after resurfacing is placed, and shall be patch-paved with asphalt concrete within 5 working days after being raised.

F. Tops of frames shall be set within to zero to 1/8-inch above finish grade. Frames which do not meet this tolerance shall be re-adjusted by the CONTRACTOR at its own expense.

G. After adjusting frames CONTRACTOR shall insure all covers are removable and seat properly when replaced. For new iron castings the new covers shall not rock.

H. Hand mixing of concrete for use in raising iron castings to grade will be allowed. Concrete shall be placed and thoroughly consolidated in conformance with Section 321300, Concrete Surface Improvements..

I. Asphalt concrete patch paving shall be fine asphalt concrete placed over a tack coat. Patch paving may be placed by hand using a vibratory plate compactor or roller in conformance with this Section.

3.17 PAVEMENT FLOOD TESTING

A. Flood testing of asphalt pavement must be made prior to the placement of striping and legends. The ENGINEER must be present to witness the flood tests. The CONTRACTOR shall notify the ENGINEER a minimum of 3 working days prior to the flood test.
B. The CONTRACTOR shall repair any areas which are damaged or in which excessive ponding occurs. Excessive ponding is defined as areas in which water stands more than 3/16-inch in depth. Any areas requiring remedial overlay shall be prepared by grinding the pertinent area as defined by the ENGINEER and placing fine asphalt concrete patch mix over a tack coat. The corrective work shall be done prior to the placement of striping and legends.

- END OF SECTION -

SECTION 321200 FLEXIBLE PAVEMENT COATINGS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and construct the flexible pavement coatings and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Work Specified in this Section:

1. Preparation and cleaning of pavement.
2. Pavement Crack Sealant.
3. Application of oil spot sealer to areas of fuel, oil and grease stains.
4. Application of emulsified asphalt slurry seal.
5. Pavement sweeping and clean-up of jobsite.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 311300	Selective Tree and Vegetation Trimming and Removal.
B.	Section 321000	Asphalt Pavement, Base, and Surface Treatments.
C.	Section 311723	Traffic Stripes and Pavement Markings.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 5	Control of Work.
Section 6	Control of Materials.
Section 37	Bituminous Seals.
Section 94	Asphaltic Emulsions.

B. **Commercial Standards:**

ISSA A105 (revised 1991)	International Slurry Surfacing Association. Recommended Performance Guidelines For Emulsified Asphalt Slurry Seal.

1.4 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall provide the ENGINEER with Certificates of Compliance and sample materials for all products and materials proposed to be used under this Section.

B. The Certificates of Compliance shall identify the name of the material, material source, name of the supplier, project name and the segment of the WORK where the material represented by the sample is to be used.

C. At least 7 working days prior to beginning pavement coating operations, the CONTRACTOR shall provide the ENGINEER with signed original laboratory reports for the mix designs which covers the specific materials to be used, per the requirements of Section 37-2.03, "Mix Design," of the Caltrans Standard Specifications and this Section.

D. The CONTRACTOR shall provide the ENGINEER with weigh tags and gallonage for all materials delivered to the job site, including aggregate, asphaltic emulsion and any additives.

E. The CONTRACTOR shall include the proposed source of aggregate in the mix design laboratory report and a material sample for the ENGINEER'S review. In addition, the CONTRACTOR shall submit a list of three (3) slurry seal projects on which the proposed aggregate was used and has demonstrated a history of holding a dark coloration.

1.5 QUALITY ASSURANCE

A. The above mix design reports shall be performed by a certified testing laboratory capable of performing the applicable ISSA tests indicated in Section 37-2.03, "Mix Design," of the Caltrans Standard Specifications and this Section.

B. The above mix design reports shall also indicate the proposed source, type and coloration of the proposed aggregate and samples of the aggregate shall be submitted by the CONTRACTOR for the ENGINEER'S review prior to use.

C. The ENGINEER will employ a certified testing laboratory to perform additional quality assurance tests and inspections as may be required by this Section.

D. The percentage of asphaltic emulsion proposed in the mix designs shall be within the percentage range specified in Section 37-2.04, "Proportioning," of the Caltrans Standard Specifications and this Section.

E. A change in either aggregate or emulsion during the course of the WORK will require submittal and approval of a new mix design and aggregate samples. Substituted materials shall not be used until the mix design and materials are reviewed by the ENGINEER. Random samples of materials and mixes will be taken by the ENGINEER during operations for further analysis and testing.

F. Once the emulsified asphalt slurry seal materials and proportions to be used are reviewed by the ENGINEER, no substitution of other materials will be permitted unless the materials proposed for substitution are first tested and a laboratory report is submitted for the substituted design as specified above and the mix design of those materials is reviewed by the ENGINEER.

1.6 QUALITY CONTROL

A. The CONTRACTOR shall comply with Section 6, "Control of Materials," of the State Standard Specifications and this Section.

B. Materials to be incorporated into the WORK shall be new and unused unless otherwise approved. In case a reference is not clear as to which of several available grades is desired, the highest quality material shall be used.

C. Materials or equipment not conforming to the requirements of this Section shall be considered as defective and shall be removed from the site of the WORK unless otherwise permitted by the ENGINEER. No rejected materials or equipment, the defects of which have subsequently been corrected, shall be used until inspected and reviewed by the ENGINEER.

D. The CONTRACTOR shall permit the ENGINEER to take samples of the aggregate and asphalt emulsion used in the WORK at the ENGINEER'S discretion. Gradation and sand equivalent tests may

be run on the aggregate and residual asphalt tests on the emulsion. The ENGINEER will compare the test results with this Section and notify the CONTRACTOR immediately if any test fails to meet specifications.

E. If any two successive tests fail on the stockpile material, the WORK shall be stopped. Before WORK can continue, the CONTRACTOR shall, at his own expense, be responsible for proving to the satisfaction of the ENGINEER that the conditions have been corrected.

F. If any two successive tests fail on the mix from the same mixer-spreader machine, the use of the machine shall be suspended. It shall be the responsibility of the CONTRACTOR, at his own expense, to prove to the ENGINEER that the problems have been corrected and that the equipment is working properly before it will be allowed for use again on the WORK.

G. All WORK will be done by persons experienced in the specific work, under competent supervision, and in a manner to the ENGINEER'S complete satisfaction as specified in Section 5-1.06, "Superintendence," and Section 5-1.12, "Character of Workman," of the Caltrans Standard Specifications.

H. The CONTRACTOR shall furnish all tools and equipment and employ sufficient trained personnel to operate all equipment and perform all handwork efficiently and skillfully.

PART 2 – PRODUCTS

2.1 EMULSIFIED ASPHALT SLURRY SEAL

A. Immediately prior to mixing, the slurry seal shall consist of a mixture of asphaltic emulsion, aggregate, water and additives (as required) in conformance with Section 37-2 of the Caltrans Standard Specifications and modified as follows:

1. Asphaltic emulsion shall be a quick setting, cationic type, in conformance with the requirements for CQS1h grade of Section 94, "Asphaltic Emulsions," of the State Standard Specifications, except that the test requirements for cement mixing and settlement shall not apply.

2. Aggregate for the slurry seal shall be in conformance with Section 37-2.02C, "Aggregate," of the Caltrans Standard Specifications for a Type II mix. The use of crushed granite or other light grey-colored aggregate will not be allowed. The aggregate shall consist of an aggregate or combination of aggregates dark in color and nature that shall be produced by crushing rock. All materials shall be free from vegetable matter and other deleterious substances, oversized particles and caked lumps.

3. Water shall be potable, and free from harmful, soluble salts.

4. Chemical retardant may be added up to one percent of dry weight of the aggregate to insure proper workability while not adversely affecting the seal.

2.2 OIL SPOT SEALER

A. Oil spot sealer shall consist of "OverKote" Oil Spot Seal manufactured by Reed & Graham, Inc., or equal, conforming to the following specifications:

1. A commercial grade, quick drying, latex emulsion sealer which shall have suitable additives to coat and promote adhesion of the flexible pavement coating to oil, grease and gasoline stained pavement.

2.3 PAVEMENT CRACK SEALANT

A. Pavement crack sealant shall be in accordance with PART 2 – "Products" of Section 321000 "Asphalt Pavement, Base and Surface Treatments."

2.4 BOND COAT

A. The bond coat shall consist of a tack coat mixture of emulsified asphalt binder and water mixed and applied uniformly to the entire surface where specified. The design mix shall conform to the Caltrans Standard Specifications and the following requirements:

1. Asphaltic Emulsion shall be in conformance with the requirements for SS1h grade of Section 94, "Asphaltic Emulsions," of the Caltrans Standard Specifications, except that the test requirements for cement mixing and settlement shall not apply.

2. Water shall be potable and free from harmful soluble salts.

2.5 ASPHALT PAVEMENT OVERCOAT

A. The asphalt pavement overcoat shall consist of a cold applied composition of petroleum sealer mixed with sand conforming to the following requirements and applied after the bond coat has dried:

1. Asphaltic Emulsion shall be of the same quality, or better, as "OverKote" asphalt pavement coating manufactured by Reed & Graham, Inc., or equal, such that it conforms to the specifications for SS1h grade per Section 94, "Asphaltic Emulsions," of the Caltrans Standard Specifications, not be of the clay type, and conform to the following minimum specifications:

SPECIFICATIONS	LIMITS	TEST METHODS
Residue at 300-400° F	55-65	See Note 1*
Dehydration, 96 hrs. at 100° F	0.6 min.	
Solubility of Residue in C_2HCl_3	15-20	AASHTO T-45-46
Loss of ignition of insoluble residue, %	16 max.	ASTM D-6
Cone penetration at 77° F, dmm	400-700	ASTM D-217

*Note 1 – Method for determination of residue:
A 25 gram sample is placed in a tin lid not less than 5" in diameter and heated on an electric hot plate at a temperature between 300-400° F for approximately 15-20 minutes until the vapor changes from white to a bluish color and bubbling ceases.

2. Sand – Sand for the overcoat mixture shall be No. 30 mesh blast sand composed of clean, hard, durable, uncoated particles, free from lumps of clay or organic matter. The use of crushed granite or other white or light gray-colored sand or aggregate shall not be allowed.

3. Water – Water shall be potable and free from harmful soluble salts.

PART 3 -- EXECUTION

3.1 ORDER OF WORK

A. All asphalt concrete pavement repairs and adjacent concrete curb and gutter repair operations shall be completed, inspected and reviewed by the ENGINEER prior to installation of the flexible pavement coating.

B. Tree and vegetation trimming and/or removal operations required for equipment accessibility shall be completed by the CONTRACTOR in accordance with Section 311300, "Selective Tree and Vegetation Trimming and Removal," prior to installation of the flexible pavement coating.

C. Prior to applying the pavement coating, all surface preparation, including pavement striping and marking removal, street cleaning and crack sealing operations shall be completed in accordance with this Section, including:

1. All weeds or other vegetation growing through the asphalt concrete shall be removed and all open cracks shall be blown clear of foreign material, including organics, sand, dirt and grease.

2. All pavement surfaces where heavy deposits of grease and oil are encountered shall be cleaned of dirt by scraping, washing with detergent, and rinsing with water. After the spots have dried, the CONTRACTOR shall seal the spots with an oil spot sealant, as specified herein, and allow to dry before application of surface coating.

3. All pavement surfaces where heavy deposits of dirt, sand, clay and other objectionable material are encountered shall be cleaned up by the CONTRACTOR through the use of high pressure blowers, vacuums or sweepers. The third paragraph of Section 37-2.06 of the State Standard Specifications is hereby amended such that the use of flushing as a means to clean the pavement prior to pavement coating placement shall not be allowed.

4. Immediately prior to pavement coating operations, all pavement surfaces shall be cleaned by vacuum sweeping to remove all loose particles of paving, dirt, vegetation and all other extraneous material and debris.

D. The ENGINEER shall review the surface preparation prior to placement of the pavement coating.

3.2 PUBLIC NOTIFICATION

A. All homeowners, businesses and public facilities affected by the WORK shall be provided with prior notification of the WORK and necessary parking restrictions, in conformance with Division 1, General Requirements. All notifications shall be in both the form of a distributed written notification, reviewed by the ENGINEER, setting the time and date that the operations will take place. The CONTRACTOR shall coordinate the notification process and follow up each notification with submittal to the ENGINEER of a signed affidavit confirming time and date of each notification.

3.3 TRAFFIC CONTROL

A. The CONTRACTOR shall use suitable measures, including signs, portable barricades, tape and flaggers, as required by this Section and the Division 1, General Requirements to protect the WORK area from damage from all types of vehicular and/or pedestrian traffic. Approval to open WORK areas to traffic does not constitute acceptance of the WORK.

B. In WORK areas which are subject to an increased rate of sharp turning vehicle or twisting tires, additional closure time may be required for a more complete cure of the seal coating to prevent damage to the pavement. Slight tire marks may be evident in these areas after opening but will diminish over time with rolling traffic. If areas should become noticeably rutted, they will be considered as abnormal characteristics of the pavement coating and will not be accepted.

3.4 PROTECTING UTILITY COVERS

A. Immediately prior to commencing pavement coating operations, all metal surface utility and monument covers shall be protected by completely covering the cover with oiled or plastic paper attached appropriately with adhesive, as approved by the ENGINEER. No adhesive or surface seal material will be permitted to cover, seal, or fill the area between the frame and cover of the structure or monument. All covers shall be exposed and cleaned of surface seal material by the end of the same working day.

3.5 OIL SPOT SEALER

A. The CONTRACTOR shall apply oil spot sealer to all street and surfaces where heavy deposits of grease and oil are encountered as part of the surface preparation. Pavement surfaces with heavy deposits of grease and oil shall be prepared by cleaning dirt and deposits off by scraping, washing with detergent and rinsing with water. After the spots have dried, the CONTRACTOR shall seal the spots with an oil spot sealant, as specified herein, and allow to dry before application of the pavement surface coating.

3.6 PAVEMENT CRACK SEALING

A. Crack sealing operations shall be in accordance with PART 3 – "Execution" of Section 321000 "Asphalt Pavement, Base and Surface Treatments."

3.7 EMULSIFIED ASPHALT SLURRY SEAL

A. Proportioning - The slurry seal mixture shall be proportioned in accordance with the requirements of Section 37-2.04 of the Caltrans Standard Specifications, except that the third paragraph of the section shall be amended as follows:

1. Asphaltic emulsion shall be added at the rate of from twelve to sixteen percent by weight of the dry aggregate. A job mix design shall be submitted by the CONTRACTOR for review by the ENGINEER that conforms to the specifications herein, and is suitable for the traffic, climate and curing conditions associated with the WORK.

2. No change in proportioning of the mix or substitution of materials shall occur without both testing and submittal of a laboratory report, as specified in the Caltrans Standard Specifications and this Section.

B. Mixing - The slurry seal shall be mixed in accordance with the requirements of Section 37-2.05 of the Caltrans Standard Specifications and this Section.

1. The ENGINEER may use the recorders, gauges and measuring facilities of each slurry seal mixer-spreader unit to determine application rates, asphalt emulsion content and additive content of individual loads.

2. The delivery rate of aggregate and emulsion per revolution of the aggregate feeder shall be calibrated at different gate settings for each mixer-spreader truck used on the project.

3. The CONTRACTOR shall check stockpile moisture content regularly and set the mixing equipment accordingly to account for aggregate bulking.

4. Samples of the slurry seal mixture may be taken directly from the mixer-spreader trucks as determined necessary by the ENGINEER. Consistency and residual asphalt content tests may be made by the ENGINEER on the samples and compared to the requirements of this Section. The ENGINEER will notify the CONTRACTOR immediately if any test fails to meet specifications.

C. Spreading Equipment - The slurry seal mixture shall be mixed in continuous pugmill mixers of adequate size and power and uniformly spread by means of a controlled spreader box and in accordance with the requirements of Section 37-2.05 of the Caltrans Standard Specifications and this Section.

1. A minimum of two 7 cubic yard or larger mixer-spreader trucks, in good operating condition, shall be on the job site at all times. Mixer-spreader equipment must be able to negotiate turns in cul-de-sacs on an initial, continuous pass next to the curb.

2. The mixer-spreader trucks shall be equipped with a pressurized water system and nozzle type spray bars to provide a fog spray immediately ahead of the spreader box. The rate of application shall be adjustable and shall cover the entire application surface without flowing or ponding.

3. If required by the ENGINEER, the mixer-spreader equipment shall be inspected and calibrated on a 300-foot test section. The CONTRACTOR shall use this calibration to establish the settings required to obtain the desired application rate for the slurry mix and to correct the proportioning of materials, in accordance with the requirements of this Section.

D. Placing - The slurry seal mixture shall be placed in accordance with the requirements of Section 37-2.06 of the Caltrans Standard Specifications, and this Section.

1. Slurry seal shall not be placed if either the pavement or the air temperature is below 50 degrees F, or when in the opinion of the ENGINEER, road conditions or imminence of inclement weather, are not conducive to successful results.

2. Slurry seal placement shall not begin before 7:00 a.m. and shall be terminated each day in sufficient time so that all streets will be open to traffic by 3:30 p.m.

3. The surface to be slurried shall be lightly pre-dampened with a fog spray of water from the applicator mounted on the mixer-spreader truck as described in "Spreading Equipment," above. The rate of application of the fog spray shall be adjusted to compensate for ambient temperature, and surface texture, and shall cover the entire surface without flowing or ponding.

4. The slurry seal mixture shall be of the desired consistency upon leaving the mixer. No lumping, balling, or unmixed aggregate shall be permitted. A sufficient amount of material shall be carried in all parts of the spreader at all times so that complete coverage is obtained. Overloading of the spreader shall be avoided.

5. The slurry seal mixture shall possess sufficient stability so that premature breaking of the material does not occur in the spreader box. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the courser aggregate. Spraying of additional water into the spreader box will not be permitted.

6. No streaks, such as those caused by oversize aggregate, shall be left in the finished surface. If excess oversize aggregate develops the job will be stopped until the CONTRACTOR proves to the ENGINEER that the situation has been corrected. Some situations may require screening

the aggregate just prior to loading it into mixer-spreader trucks going from the stockpile area to the lay down operation.

7. The slurry seal machine shall move forward at such a speed that the slurry seal mixture penetrates and substantially fills all surface voids in the existing pavement.

8. The forward speed of the slurry seal spreader shall be maintained so as not to cause corrugations and surface irregularities in the slurry seal.

9. The slurry box squeegees, rubber belting or similar material, shall be flexible enough to wipe the slurry uniformly over the surface of the existing pavement without gouging, scouring or abrading the surface.

10. Slurry seal shall be placed to the limits as shown on the drawings, as marked in the field, and as directed by the ENGINEER. Where recently resurfaced streets intersect with the project limits, slurry material shall be extended to provide a minimum overlap beyond the edge(s) of recent resurfacing, as marked in the field or as directed by the ENGINEER, irrespective of typical project limits.

11. The edges of the slurry seal application on both sides of the street shall be maintained in a neat and uniform line. Along concrete gutters, the slurry seal shall overlap the lip of gutter approximately one (1) inch maximum to seal the joint along the edge of the concrete. No runoff into the gutter will be permitted. Where there is no concrete gutter, the slurry seal shall extend to the limits of the existing asphalt pavement.

12. Areas which cannot be reached with the slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be handworked shall be lightly dampened prior to mix placement and the slurry worked immediately. Care shall be exercised to leave no unsightly appearance from handwork. The same type of finish as applied by the spreader box shall be required. Handwork shall be completed during the machine applying process.

13. The CONTRACTOR shall use 15-lb. roofing paper at slurry seal transverse limits and stop/start butt joint conforms to maintain a neat and uniform line and thickness of slurry seal at conforms. The CONTRACTOR shall position the paper to provide a minimum overlap at conforms, avoid double placement of material at stop/start joints, and hold excess slurry for easy removal without spillage.

14. Wherever possible, longitudinal lap joints shall coincide with lane lines or in the center of the lane. In no case will joints be allowed in the normal wheel track of vehicles. Care shall be taken to avoid leaving ridges at the lap joints between adjoining passes.

15. The CONTRACTOR shall not continue to the next street until all handwork has been completed and all excess slurry along gutters, walks and drives has been removed to the satisfaction of the ENGINEER.

16. All excess and unsuitable material within the street right-of-way shall be removed as it develops or no later than the end of each work day.

17. The CONTRACTOR shall not use diesel fuel or solvents of any kind for cleaning tools and equipment in such a manner as to permit spillage of the diesel fuel or solvent.

18. The CONTRACTOR shall be responsible for all damage to the slurry seal coat until it cures. All damaged areas shall be patched or the street re-slurried as directed by the ENGINEER at the CONTRACTOR'S expense.

E. Rolling - The CONTRACTOR shall roll the slurry seal once it has cured enough so as to not pick up on the tires of the roller. All surfaced areas shall be subjected to a minimum of two (2) full coverage passes by a self-propelled 10 ton pneumatic roller equipped with water spray. Tire pressure shall be set at 50 psi.

F. Sweeping - After the slurry seal has cured, the CONTRACTOR shall perform additional sweeping in to remove excess loose material per this Section.

1. The CONTRACTOR shall notify the ENGINEER of its proposed sweeping schedule.

2. The CONTRACTOR shall adjust the sweeping schedule at the discretion of the ENGINEER should unforeseen circumstances arise.

3. Within 4 to 7 calendar days after slurry seal has cured, the CONTRACTOR shall perform an initial sweeping operation on all slurry seal areas to remove excess loose material.

4. Within 10 to 14 calendar days after the slurry seal has cured, the CONTRACTOR shall perform a second sweeping operation in those areas of excess ravelling as directed by the ENGINEER.

5. The CONTRACTOR shall also perform additional sweeping operations after the second sweeping as determined necessary by the ENGINEER. The CONTRACTOR shall perform the required additional sweeping operations within 48 hours of the ENGINEER'S notification.

3.8 BOND COAT AND ASPHALT PAVEMENT OVERCOAT:

A. Proportioning:

1. The bond coat shall consist of a tack coat mixture of one (1) part emulsified asphalt binder (SS1h grade) and four (4) parts water.

2. The asphalt pavement overcoat shall be proportioned, mixed, and applied in a manner that takes into account the surface roughness of the pavement. The proportions of materials and the number of applications required shall be in accordance with those contained in the mix design submittal and the manufacturer's specifications as approved by the Engineer.

B. Mixing: The mixing or agitating equipment utilized by the contractor shall be a tank-type power mixer with a round bottom and shall be a power driven mixer of sufficient capacity to maintain the mineral content of the overcoat in suspension prior to application.

C. Placing:

1. No asphaltic emulsion products shall be placed when either the pavement or the air temperature is below 50°F, or when in the opinion of the Engineer, pavement conditions or imminence of inclement weather, are not conducive to successful results.

2. Placement shall not begin before 7:00 a.m. and shall be terminated each day in sufficient time so that all barricades may be removed prior to the end of the work day.

3. The Contractor shall remove all existing pavement markings, paint and thermoplastic, within the limits of the overcoat area as part of the pavement preparation process.

4. The Contractor shall protect all buildings, fences, utility boxes, storm drain grates, and adjacent concrete cubs, gutters, and sidewalks from overspray, spillage, and tracking during application of the bond coat and overcoats.

5. The Contractor shall apply the bond coat over the entire asphalt pavement to be overcoated at a rate of 0.05 to 0.10 gallon per square yard. The bond coat shall be allowed to dry prior to placement of the overcoat. Any pools of wet binder remaining in depressions shall be swept out and allowed to dry before applying the overcoat.

6. Prior to the first application of overcoat in hot weather, the Contractor shall dampen the pavement surface. Any excess water shall be removed to leave the surface only slightly damp prior to application.

7. In general, for the purposes of bidding the project, two (2) or more applications of overcoat mixture are required for the surface roughness with 3 pounds of 30 mesh sand and adequate water added per gallon of sealer (not to exceed 15% by volume) to the first application to obtain a semi-fluid consistency, and another application of sealer made without the application of sand as necessary to obtain a smooth and uniform surface. The quantity of undiluted sealer to be applied per 1,000 square feet of area shall also be determined in the mix design submittal, but is estimated at a minimum of 30 gallons per 1,000 square feet of area for the purposes of the bid. In the field, the controlling factor shall not be the quantity of sealer used, but that the finished surface shall be smooth and uniform, showing no evidence of course or uneven texture.

8. The asphalt pavement overcoat shall be applied by the combined use of rubber-faced squeegees and mechanized material spreading equipment or other suitable methods approved by the Engineer. The material should be applied to the area in continuous parallel lines and spread immediately by the use of rubber-faced squeegees and/or mechanized materials spreading equipment. Care shall be taken to avoid leaving ridges at the lap joints between adjoining passes.

9. Asphalt pavement overcoat material shall be placed to the limits as indicated on the plans and as directed by the Engineer. Where curbs and sidewalks exist, the overcoat shall seal the joint between the edge of pavement and the concrete, but shall not overlap onto the concrete. The Contractor shall use 15 lb. roofing paper to start and stop at sidewalks, in order to ensure a straight line conform and hold excess material for easy removal. The edge limits of the overcoat application shall extend to the existing edges of pavement.

10. All excess and unsuitable materials resulting from the Contractor's operations shall be removed as it develops by the end of each work day.

11. The Contractor shall not use diesel fuel or solvents of any kind for cleaning tools and equipment in such a manner as to permit spillage of the diesel fuel or solvent.

12. The Contractor shall be responsible for all damage to the overcoat until it cures. All damaged areas shall be re-coated as directed by the Engineer at the Contractor's expense.

13. After the pavement overcoat has cured, and during the duration of the contract, the Contractor shall perform additional sweeping in areas of excess raveling, as directed by the Engineer.

- END OF SECTION -

SECTION 321300 - CONCRETE SURFACE IMPROVEMENTS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor to furnish and install all concrete surface improvements including concrete curbs, median curbs, gutters, valley gutters, sidewalks, access ramps, bus turnouts, driveways, median nose surfacing, pads, miscellaneous concrete footings, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. **Work Covered in this Section:**

1. Subgrade Preparation.
2. Root Pruning.
3. Aggregate Base.
4. Sidewalk Drains.
5. Forms for Concrete.
6. Concrete Reinforcement.
7. Portland Cement Concrete Placement.
8. Expansion Joints.
9. Deep Joints.
10. Score Lines.
11. Curing Compound.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 311316	Root Pruning.
B.	Section 310000	Earthwork.
C.	Section 321000	Asphalt Pavement, Base and Surface Treatments.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

1. Standards Specifications:

Section 19	Earthwork.
Section 26	Aggregate Bases.
Section 73	Concrete Curbs and Sidewalks.

2. Standard Plans

2.6 CURING MATERIALS

A. All curing compound shall be of the non-pigmented type in conformance with ASTM C 309, Type 1-D, Class A.

2.7 ACCESS RAMPS

A. Access ramps shall conform to the "Curb Ramp Details" of the Caltrans Standard Plans.

B. Detectable Warning Surfaces shall be manufactured by Armor Tile Tactile Systems, dark gray in color, or approved equal.

PART 3 – EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall be in conformance with Section 310000, "Earthwork," and Section 321000, "Asphalt Pavement, Base and Surface Treatment."

B. Finish subgrade shall be within the tolerances established in Section 19-1, "General," of the Caltrans Standard Specifications.

3.2 SAWCUTTING EXISTING CONCRETE IMPROVEMENTS

A. Where a portion of existing concrete surface improvements is to be removed and replaced, the section to be removed shall be sawcut with an approved concrete saw to a minimum depth of 1-1/2 inches. For sidewalks, access ramps, and driveways the limit of the saw cut shall be at a minimum the first score line beyond the limits of the area to be replaced or as directed by the ENGINEER. For curb and gutter the limit of the sawcut shall be the nearest deep joint or as directed by the ENGINEER.

3.3 ROOT PRUNING

A. Where existing concrete improvement replacement is required due to tree root intrusion the tree roots shall be pruned in conformance with PART 3 - EXECUTION of Section 311316, "Root Pruning."

3.4 AGGREGATE BASE

A. Aggregate base shall be spread and compacted in conformance with PART 3 - EXECUTION of Section 321000, "Asphalt Pavement, Base and Surface Treatments." The aggregate base shall be placed to the depth as shown on the Drawings.

3.5 FORMS FOR CONCRETE

A. No forms shall be placed prior to approval of the aggregate base and subbase by the ENGINEER.

B. All concrete surface improvements may be placed by slip form paver, and curb and gutter may be placed by extrusion machine.

3.6 CONCRETE REINFORCEMENT

A. Concrete reinforcement and dowels shall be placed at the location as shown on the Drawings. Installation of concrete reinforcement and dowels shall be in conformance with Section 033050, "Utility Cast-in-Place Concrete."

3.7 SIDEWALK DRAINS

A. Pipe for sidewalk drains shall be placed and installed as specified on the Drawings.

3.8 PORTLAND CEMENT CONCRETE

A. No concrete for concrete surface improvements shall be placed until the subgrade, aggregate base, forms and reinforcement, and sidewalk drains have been approved by the ENGINEER.

B. Concrete curbs, gutters, valley gutters, sidewalks, access ramps, bus turnouts, driveways, and miscellaneous concrete footings shall be constructed in conformance with Section 73, "Concrete Curbs and Sidewalks," of the Caltrans Standard Specifications, except that hand mixing of Portland cement concrete for use in concrete surface improvements will not be allowed, and except as modified in this Section.

C. Concrete surface improvements shall not exceed the tolerances established in Section 73, "Concrete Curbs and Sidewalks," of the Caltrans Standard Specifications.

D. When a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1-1/2 hours, or before 250 revolutions of the drum or blades, whichever comes first, after the introduction 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, a time less than 1-1/2 hours may be required.

E. All existing square formed steel tube sign posts shall be protected prior to pouring concrete around the post such that no concrete will leak inside the post.

3.9 JOINTS

A. **Expansion Joints:** Expansion joints shall be placed at 200-foot spacings and at all changes in horizontal alignment.

B. **Deep joints:** Deep joints shall be placed at all driveway edges and at 10 foot spacing. Depth of deep joint shall be 3/4-inch.

C. **Score lines:** Score lines shall be placed transversely at 5-foot spacing between deep joints, longitudinally along back of curb, and longitudinally at mid-point on sidewalks over 8 feet in width.

D. When replacing concrete improvements score lines and deep joints shall match existing score line and deep joint spacing.

3.10 CONCRETE FINISH

A. All concrete surface improvements, except access ramps and miscellaneous concrete footings, shall have a soft broom finish. Access ramp surface finish shall conform to the "Curb Ramp Details" of the CalTrans Standard Plans.

B. Miscellaneous concrete footings shall be sloped to provide drainage away from the post/pipe.

3.11 CURING

A. All exposed surfaces of Portland cement concrete shall be cured in conformance with the manufacturer's printed recommendations.

- END OF SECTION -

SECTION 321723 - TRAFFIC STRIPES AND PAVEMENT MARKINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and place all traffic stripes and pavement markings, which may include but is not necessarily limited to, removal of any existing striping, legends, and pavement markers; repair of damaged pavement; placement of pavement markers; placement of both thermoplastic and painted striping and marking; and all other appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 321000 Asphalt Pavement, Base, and Surface Treatments.

B. Division 1 General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications and Standards:**

United States Department of Transportation, Manual of Uniform Traffic Control Devices

B. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 15 Existing Highway Facilities.

Section 84 Traffic Stripes and Pavement Markings.

Section 85 Pavement Markers.

Section 94 Asphalt Emulsions.

2. Standard Plans.

3. Traffic Manual.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. **General:** Unless otherwise noted on the Drawings, all permanent traffic stripes and pavement markings shall be thermoplastic and/or pavement markers.

B. **Thermoplastic:** Thermoplastic for traffic stripes and pavement markings shall conform to Section 84-2, "Thermoplastic Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.

When thermoplastic marking is applied within a crosswalk or a bike lane, the following composition shall be used with a maximum thickness of 0.12 inches (3.0 mm):

Binder 20% (18% min)
Glass Beads 20% (15% min)
TiO_2 Pigment 10% (7% min)
Filler 35% (37% max)
Cullet 1 5 % (10% min)

The crushed glass cullet in such mixture shall be produced from cullet of clear glass, with a maximum size of 850 micrometers (100% passing by weight) and a minimum size of 425 micrometers (0-5%% passing by weight). The skid resistance shall be a minimum of 55 BPN.

C. **Paint:** Paint for traffic stripes and pavement markings shall conform to Section 84-3, "Painted Traffic Stripes and Pavement Markings," of the Caltrans Standard Specifications.

D. **Pavement markers:** Pavement markers shall conform to Section 85, "Pavement Markers," of the Caltrans Standard Specifications and as specified herein. Fire Hydrant markers shall be two-way, reflective blue markers.

E. **Pavement arrows:** Type II and III pavement arrows shall be installed on streets with speed limits of 45 mph or greater. Type I(10), IV, VII, and VIII pavement arrows shall be installed on all other streets.

2.2 ADHESIVE

A. Adhesive shall be the hot melt bituminous type conforming to Section 85, "Pavement Markers," of the Caltrans Standard Specifications.

PART 3 -- EXECUTION

3.1 GENERAL

A. Centerline and lane lines shall be re-established the same day as they are removed by the use of temporary reflective markers placed at 24-foot maximum spacing.

B. Stop bars, crosswalks, advanced school crossing legends and arrows, shall be re-established the same day as they are removed using paint or traffic tape and shall match the width, size, and color as the removed markings unless otherwise shown on the Drawings.

C. Temporary traffic stripes and pavement markings placed on the finish lift of asphalt concrete shall be made with temporary traffic tape. Temporary traffic stripes and pavement markings placed on sub-lifts of asphalt concrete may be made with paint or traffic tape. Traffic tape will not be placed on slurry seal surfaces.

3.2 REMOVE EXISTING TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. All removed traffic stripes and pavement markings and excess material shall become the property of the CONTRACTOR and shall be disposed of in a legal and proper manner. Removal and disposal of existing traffic markings and excess material shall conform to Section 15, "Existing Highway Facilities," of the Caltrans Standard Specifications and as specified herein.

B. The CONTRACTOR shall conduct his work so as not to damage existing pavement and public improvements to remain. Any resultant damage determined to be excessive by the ENGINEER shall be repaired in kind by the CONTRACTOR at its sole expense.

C. Damage to the pavement resulting from removal of pavement markers shall be considered as any depression more than 1/4-inch deep and shall be repaired by the CONTRACTOR by filling the depression with hot melt bituminous adhesive to the satisfaction of the ENGINEER.

D. Where blast cleaning is used for the removal of traffic stripes and pavement markings or objectionable material, the residue including dust shall be removed immediately after contact between the sand and the surface being treated. Such removal shall be by a vacuum attachment operating concurrently with the blast cleaning operation.

E. Where removal of traffic stripes and pavement markings is done by grinding or sandblasting methods, the effected pavement surface shall be completely covered by applying asphaltic emulsion conforming to Section 94 of Caltrans Standard Specifications.

F. All reference markings made by the CONTRACTOR shall be done with spray chalk.

G. All temporary traffic stripes and pavement markings shall be removed by the CONTRACTOR on the same day as placement of the permanent striping and markings.

3.3 TRAFFIC STRIPES AND PAVEMENT MARKINGS INSTALLATION

A. Placement of all traffic stripes and pavement markings shall be in conformance with Section 84, "Traffic Stripes and Pavement Markings," and Section 85, "Pavement Markers" of the Caltrans Standard Specifications, referenced Plans of the Caltrans Standard Plans, as shown on the Drawings and as specified herein.

B. All layouts must be inspected and approved by the ENGINEER prior to permanent placement of the traffic stripes and pavement markings. The CONTRACTOR shall notify the ENGINEER no later than 48 hours prior to the start of the scheduled placement.

C. Any overlap, dripping, or tracking of fresh thermoplastic or paint onto unmarked surfacing shall be removed to the satisfaction of the ENGINEER.

D. Thermoplastic and paint shall be placed as close as possible to existing utility structure and monument frames and covers without covering them.

E. The CONTRACTOR shall protect all fresh thermoplastic and paint and shall repair or replace all damage to traffic stripes and pavement markings caused by his failure to do so at its own expense.

F. All traffic stripes and pavement markings, new or existing, within or adjacent to the WORK limits which become defaced or damaged during the CONTRACTOR'S operations shall be replaced by the CONTRACTOR at its expense concurrently with other traffic marking operations in the immediate area. The ENGINEER shall be the sole judge as to which stripes or legends are defaced or damaged.

G. Fire hydrant markers shall be installed at all fire hydrant locations as shown on the Drawings.

- END OF SECTION -

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install chain link fencing and gates, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

B. Where the WORK requires temporary removal and replacement of existing fences, the fences shall match the adjacent fence.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 321300	Concrete Surface Improvements
B.	Section 033050	Utility Cast-in-Place Concrete.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (CALTRANS) Standards:**

1. Standard Specifications:

Section 80	Fences.

B. **Commercial Standards:**

ASTM F668	Standard Specification for Poly (Vinyl Chloride)(PVC) - Coated Steel Chain Link Fence

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. Product data sheets for gates, typical fence construction, and fence corner construction shall be submitted to the ENGINEER for review prior to fabrication and construction.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Fencing shall be 3 feet or 6 feet high, unless otherwise specified on the Drawings. All fencing materials shall be hot-dip galvanized after fabrication. All materials and components shall be new, first quality items specifically manufactured for the intended application. All fencing shall be vinyl coated steel chain link fabric.

B. All galvanized fence material shall be galvanized in accordance with Section 80-4, "Chain Link Fence," of the Caltrans Standard Specifications. All steel parts shall be hot-dipped galvanized prior to vinyl coating.

2.2 MATERIALS

A. Fence fabric without slats shall be No. 11 gage galvanized steel wire, 2 inch mesh. Fence fabric with slats shall be a No. 9 gage galvanized steel wire, 2-inch mesh. The fabric shall have a knuckled finish on the top and bottom edge.

B. Fabric ties shall be galvanized steel wire of the same gage as fence fabric, spaced 14 inches apart on posts. Aluminum ties will not be permitted. A continuous No. 7 gage galvanized steel tension wire shall be interlaced with the fabric or attached to the fabric with clips along the extreme top and bottom of the fence.

C. Posts shall be one-piece without circumferential welds, and shall be:

1. Line Posts:

a. Fence With Slats - Posts shall be 2 inch Schedule 40 pipe, 3.65 lb./ft.

b. Fence Without Slats - Posts shall be 1-1/2 inch Schedule 40 pipe, 2.72 lb./ft.

2. End and Corner Posts:

a. Fence With Slats - Posts shall be 2-1/2 inch Schedule 40 pipe, 5.79 lb./ft.

b. Fence Without Slats - Posts shall be 2-inch Schedule 40 pipe, 3.65 lb./ft.

3. Gate posts shall be 3-1/2 inch Schedule 40 pipe, 9.1 lb./ft.

D. Braces shall be 1-1/4 inch Schedule 40 pipe, 2.27 lb./ft.

E. Truss Rod and turn buckle shall be in conformance with Section 80-4, "Chain Link Fence," of the Caltrans Standard Specifications.

F. Fence stretcher bars shall be 1/4-inch by 3/4-inch galvanized steel bars, and steel bands for fastening stretcher bars to the posts shall be 1/8-inch by 3/4-inch.

G. Nuts, bolts and screws shall be of steel, hot-dipped galvanized after fabrication, minimum size 3/8-inch diameter.

H. Fence swing gate frames shall be constructed of 1-1/2 inch Schedule 40 pipe, minimum, and shall be fabricated by welding with all welds ground smooth prior to hot-dip galvanizing. Each gate leaf shall be provided with at least one diagonal brace. Frames shall be galvanized after fabrication. Galvanized malleable iron fittings for latching the gate shall be provided. Swing gates shall be hung by at least 2 steel or malleable iron hinges not less than 3 inches in width. Fabric shall match the fabric used in the fence. Each pair of gates shall be provided with a heavy drop rod latch assembly with a locking device for a padlock.

I. Fence sliding gates shall be track guided cantilever type. They shall be engineered and designed special for opening size and opening directions. Their construction shall be similar to that specified for swing gates. The gate components shall be engineered for proper piping and bracing size, and shall be provided complete with all necessary operating hardware including, but not necessarily limited to the following: tracks, supports, brackets, guides, heavy duty rollers with roller or ball bearings, and finish hardware. They shall be engineered for not less than a wind load of 25 lb./sq. ft. and maximum deflection of 1/160 of the full span with a 200-pound live load at the free end. The completed, welded, gate frame units and any ungalvanized hardware shall be hot-dip galvanized after fabrication. The cantilever gates shall have a free clear space under them of not less than 4 inches.

J. Concrete shall be a Class C in conformance with City Standard Detail G-6..

K. Slats shall be high density polyethylene blend, UV stabilized wide slat resistant to chemicals, salt & petroleum products, 3/8-inch by 2-1/2 inch. Unless otherwise specified, the color shall be Redwood.

L. Vinyl coated steel chain link fabric shall be No. 11 gauge steel wire, 2-inch mesh in accordance with ASTM F668, Class 2B. The color shall be as specified on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All earth, brush, or other obstructions which interfere with the proper alignment of construction of fences and gates shall be removed and disposed of at the expense of the CONTRACTOR.

B. Fence line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts and measured generally parallel to the ground slope. Line posts shall be set plumb and shall be centered in 12 inch diameter concrete footings extending 39 inches into the ground.

C. Fence end posts and corner posts shall be set plumb, and shall be centered in 12 inch diameter concrete footings extending 39 inches into the ground.

D. Gate posts shall be provided with a concrete footing in accordance with the manufacturer's printed recommendation.

E. Where a horizontal fence alignment angle is 15 degrees or more corner posts shall be installed in lieu of line posts.

F. Bracing shall be provided at all end, gate, and corner posts, the latter in both directions. Horizontal brace rails shall be set 6 inches below top of fence fabric running from the corner, end, or gate post to first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

G. Fence corner posts shall be installed in lieu of line posts at intervals not exceeding 500 feet and shall be braced horizontally in both directions.

H. The fabric shall be fastened on the side of the posts as shown or as designated by the ENGINEER. The fabric shall be stretched and securely fastened to the posts, and between the posts the fabric shall be fastened to the top and bottom tension wires and the truss rod. The truss rod shall be stretched tight with turnbuckles at the end and corner posts.

I. The fabric shall be fastened to the end, corner, and gate posts with stretcher bars and stretcher bar bands spaced at approximately 14 inches on line posts and at approximately 18 inches on tension wires.

J. Concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating in an approved manner. Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing the concrete, the earth around

the hole shall be thoroughly moistened. The concrete shall completely fill the hole and top surfaces of the concrete shall be crowned and sloped away from the post to shed water and shall have a neat appearance. Not less than 7 days shall elapse after placing the concrete footings before the fence fabric is fastened to the posts.

K. Any galvanized coating damaged during construction of the fencing and gates shall be repaired by application of molten **Galvo-Weld; Galvinox; or equal.**

- END OF SECTION -

SECTION 330130 - SANITARY SEWER AND STORM DRAIN SYSTEM LEAKAGE TESTING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor to perform and complete pipeline flushing and testing, complete, for sanitary sewer and storm drain system piping, as specified herein.

B. The CONTRACTOR shall be responsible for conveying test water from the source to the point of usage and also for proper disposal, as required, of water used in the testing operations. All costs associated with supply and disposal of test water shall be at the CONTRACTOR'S expense.

C. Structural (Deflection) testing requirements for sanitary sewers and storm drains are as specified in the various appropriate piping sections.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM C 828	Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

1.3 CONTRACTOR SUBMITTALS

A. A testing schedule, including proposed plans for conveyance, control and disposal of test water shall be submitted in writing to the ENGINEER for review a minimum of 72 hours before testing is to start.

B. The CONTRACTOR shall submit laboratory calibration certificates for all gages to the ENGINEER for review along with the testing schedule.

PART 2 -- PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. All testing equipment and materials shall be provided by the CONTRACTOR. No materials shall be used which would be injurious to pipeline system or structure and future function. All test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the CONTRACTOR'S expense prior to the leakage test.

PART 3 -- EXECUTION

3.1 GENERAL

A. All lines shall be cleaned and flushed prior to testing using a "Wayne Ball," high pressure sewer "jets," or other methods acceptable to the ENGINEER.

B. CONTRACTOR will be solely responsible for the proper disposal of all water used in the flushing and testing process. Disposal of all water shall be in accordance with appropriate regulatory agency requirements.

C. All flushing and testing operations shall be performed in the presence of the ENGINEER.

3.2 TESTING OF MAINTENANCE HOLES

A. All sanitary sewer maintenance holes shall be vacuum tested for leakage after installation in the presence of the ENGINEER. Prior to vacuum testing all maintenance holes shall be visually inspected for leaks. All leaks, cracks and lift holes shall be repaired by the CONTRACTOR, prior to vacuum testing, to the satisfaction of the ENGINEER. All repairs shall be made with non-shrink grout. The CONTRACTOR shall test the maintenance hole up to and including the cone, and shall make all repairs as necessary to achieve a final passing test. Any alternative repair methods shall be approved by the ENGINEER. All pipe inlets and outlets in the maintenance hole shall be securely plugged to sufficiently hold against vacuum pressure during testing, and removed following successful completion of the testing. A rubberized test plate shall be placed on the maintenance hole dome after potential leaks on the top of the dome have been sealed.

B. A suitable vacuum pump shall be used to reduce the pressure inside the maintenance hole to a vacuum of ten (10) inches of mercury, stabilizing the vacuum at ten (10) inches of mercury for one (1) minute. The vacuum pump shall be shut off, and with the valves closed, the increase (loss of vacuum) shall be measured inside the maintenance hole during the test hold period. The maximum allowable pressure increase (loss of vacuum) shall be one (1) inch of mercury over a sixty (60) second test hold period. If vacuum drops below nine (9) inches of mercury within the test period, the leakage shall be considered excessive. The CONTRACTOR shall make all repairs necessary to achieve a passing test and the maintenance hole shall be retested. Maintenance holes repairs and retesting shall proceed until a passing test is completed.

3.3 TESTING OF PIPING SYSTEMS

A. **General:** All sanitary sewer and storm drain systems and service laterals shall be tested as specified. All sanitary sewer gravity lines shall be tested for leakage using a low pressure air test. All sanitary sewer maintenance holes shall be tested for leakage, as specified. Maintenance holes shall be tested prior to backfill placement, whereas all pipe shall be backfilled prior to testing. All leakage tests shall be completed and approved prior to placing of permanent surfacing. When leakage exceeds the amount allowed, the CONTRACTOR at its expense, shall locate the leaks and make the necessary repairs or replacements in accordance with the Specifications to reduce the leakage to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.

B. During flushing of the sewer lines, the maintenance hole at the low end of the new line shall be plugged and incoming water pumped to a drain point approved by the CITY. Before the plug can be removed, all sand, silt, gravel and other foreign material shall be completely removed from the maintenance hole.

C. **Deflection:** All PVC non-pressure pipe shall be tested for deflection obstructions and protruding laterals by passing a "mandrel" from the nearest downstream structure to the nearest upstream structure. The "deflection test" procedure shall be acceptable to the ENGINEER. The 'mandrel' diameter shall be 95 percent of the pipe inside diameter.

D. **Air Pressure Test:** The CONTRACTOR shall furnish all materials, equipment and labor for making an air test. Air test equipment shall be approved by the ENGINEER.

The CONTRACTOR may conduct an initial air test of the sewer main line after densification of the backfill but prior to installation of the laterals. Such tests will be considered to be for the CONTRACTOR'S convenience and need not to be performed in the presence of the ENGINEER.

Each section of the sewer shall be tested between successive maintenance holes by plugging and bracing all openings in the main sewer line and the end of all laterals. Prior to any air pressure

testing, all pipe plugs shall be checked with a soap solution to detect any air leakage. If any leaks are found, the air pressure shall be released, the leaks eliminated and the test procedure started over again.

The final leakage test of the sewer main line and laterals shall be conducted in the presence of the ENGINEER. The time and procedure for air testing vitrified clay pipe (VCP) shall be calculated in accordance with ASTM C 828.

For other pipe types, the test procedure shall be conducted by first increasing the pressure within the line to approximately 4 psi using a compressed air supply. After the air supply is turned off or disconnected, there shall be a two minute waiting period to allow stabilization of air within the sewer line before the actual test begins. In no case shall the test pressure within the line be less than 3.5 psi when the test begins. The allowable air pressure loss shall not exceed 1 psi. After completion of the test, the air pressure shall be released slowly and the test plugs shall not be removed until the air pressure is no longer measurable. The test periods for all sewer pipes other than VCP shall be determined using the Ramseier's equation, as follows:

$$T = 0.085 * \frac{DK}{Q}$$

Where: T = Shortest time, in seconds, allowed for the air pressure to drop to 1.0 psig.
K = 0.000419 DL, but not less than 1.0.
Q = 0.0015 cubic feet/minute/square feet of internal surface.
D = Nominal pipe diameter in inches.
L = Length of pipe being tested in feet.

At the CONTRACTOR'S option, joints may be air tested individually, joint by joint, with the use of specialized equipment. The CONTRACTOR shall submit its joint testing procedure for the ENGINEER'S review prior to testing. Prior to each test, the pipe at the joint shall be wetted with water. The maximum test pressure shall be 3.0 psi. The minimum allowable pressure drop shall be 1.0 psi over a 30-second test period.

E. **T.V. Inspection:** All sanitary sewer systems shall be TV inspected. In addition, all storm drain systems are subject to TV inspection. In all paved areas the TV inspection must be coordinated by the CONTRACTOR to allow sufficient time for the TV inspection to be performed prior to the final lift of asphalt paving being placed. The CITY or approved TV testing company will perform the TV inspections. The CONTRACTOR shall repair all problems revealed by the TV inspection. The CONTRACTOR shall coordinate with the ENGINEER to arrange for a compatible time to conduct the inspection.

F. **The Contractor shall contact the Water Resources Division for a list of approved TV testing companies.**

G. **The Contractor shall submit the sanitary sewer video tape (VHS) to the City for review. Tape shall become the property of the City.**

3.4 FLOW TESTING OF EXISTING COMMERCIAL/INDUSTRIAL SEWER LATERALS

A. Prior to connecting to all existing sewer laterals other than single family residential units, the CONTRACTOR shall flush test the existing sewer lateral with water in the presence of the ENGINEER to determine if the lateral is damaged

- END OF SECTION -

SECTION 330526 - PIPING IDENTIFICATION SYSTEMS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, mark, and install identification devices for piping, valves, and appurtenances using warning tape, buried wire, color codes, lettering, and related permanent identification devices as required and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 331219	Fire Hydrants.
B.	Section 055900	Ductile Iron Pipe
C.	Section 099000	Protective Coating
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI A13.1	Scheme for the Identification of Piping Systems.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 IDENTIFICATION OF BURIED PIPING

A. Identification of all buried pressure pipe shall be accomplished by color-coded warning tape consisting of a minimum 2 inch wide plastic tape with lettering giving a warning and a description of the pipe function (for example: "WARNING, WATER LINE BURIED BELOW"). For pipe diameters larger than 12 inches the warning tape shall be a minimum 6 inch wide. Identification color codes shall be as listed in the IDENTIFICATION SCHEDULE in PART 3 – "Execution" of this Section.

B. Warning Tape manufacturer shall be **THOR ENTERPRISES, CALPICO, or equal.**

C. In addition, for all non-metallic buried pressure pipe systems a No. 10 A.W.G. UF Insulated solid copper wire shall be attached to the pipeline.

D. Tape to hold the wire in place shall be pipe wrap tape, 2 inches wide, 10 mil.

2.2 RECYCLED WATER SIGNING

A. All identification signs and stickers for irrigation controllers for recycled water systems are to be purchased by the CONTRACTOR from the Water Resources Division located at 101 West Jack London Boulevard, Livermore, CA.

2.3 PAINT MANUFACTURERS AND COLORS

A. Paint manufacturers and colors shall be as specified in Section 099000 "Protective Coating."

PART 3 -- EXECUTION

3.1 WARNING TAPE

A. Warning tape shall be installed with all buried pressure piping. The tape shall be placed directly at the top of the Pipe Zone.

3.2 COPPER WIRE

A. Buried non-metallic pressure pipelines for potable/recycled water systems, sewer force main systems and irrigation mains shall be provided with an USE-2 Insulated copper wire laid along the top of the pipe. On main line installations the wire shall be held in place with ties or tape spaced not more than 10 feet apart. On service laterals the wire shall be wrapped around the pipe. At all buried valves install copper tracer wire on the outside of the polyvinyl chlorite valve sleeve to a notch cut out at the top of the valve sleeve.

3.3 IDENTIFICATION SCHEDULE

A. Application of identifying water systems and devices shall conform to the following color codes.

B Blue (Potable)
G Green
P Purple (Recycled)
R Red
W White
Y Yellow

	FH	Valve Lid	Dist. /Type in Face of Curb	"W" on top of Curb over Service	Vent Pipe	Guard Post	Marker Post
Sanitary Sewer/Storm Drain System	-	-	-	-	-	-	G
Water Sampling Station	-	-	-	-	-	W	-
Potable Fire Hydrants	Y or R	W	R	-	-	W	-
Dedicated FS, street valves	-	-	R	W	-	-	-
All other main line potable valves	-	B	W	-	-	-	W with B top
Recycled	P	P	P	P	-	W	W with P top
Comm/Ind Dom/Fire	-	W	W	W	-	-	W with B top
Manifold	-	W	W	W	-	-	-
Air Release Valve	-	-	W	-	*W with B or P	-	-

* Vent pipe on Air Release valves: white post with top 6 inches of pipe B or P, with 3" "AR" in B or P 12" below top of pipe facing curb, color to match top 6" of pipe.

3.4 RECYCLED WATER SIGNING

A. All recycled hydrant signs will be installed on a square formed steel tube, telescoping metal breakaway type post in accordance with PART 2 "Products" and PART 3 "Execution" of Section 02891 "Signage." Signs shall be located behind the hydrant between 36" and 48" from the center of hydrant. The top of the sign shall be level with the top of the hydrant.

B. The locations of all signage for landscape irrigation systems shall be as approved by the Water Resources Division.

Irrigation controllers will also contain the purple recycled water sticker. The following message on the irrigation controller sticker will be printed in English and Spanish:

CONTROLLER OPERATES IRRIGATION SYSTEM USING RECYCLED WATER

1. Controller Operation hours: 10:00 p.m. p.m. to 6:00 a.m.
2. Operate controller to minimize overspray and runoff.
3. Maintain controller schedule and system map located inside.
4. Failure to comply may result in loss of service.

UNAUTHORIZED OPERATION PROHIBITED

C. All recycled water piping and purple warning tape will be clearly marked stating "**Caution: Recycled Water - Do Not Drink.**" All purple polyethylene encasement for recycled water piping shall be clearly marked stating **"Caution: Recycled Water – Do Not Drink."**

D. All recycled water meters, valves, covers, backflow preventers and other appurtenances shall be painted purple.

E. All recycled water stickers shall be purple, with white lettering.

F. All internal signs (building interiors) shall be purple, with white lettering stating **"Caution: Recycled Water - Do Not Drink."**

G. Dual plumbed buildings shall have all internal and external water spigots clearly marked with the appropriate small blue metal sign for potable water or the small purple metal warning sign for recycled water.

- END OF SECTION -

SECTION 331100 - PIPING, GENERAL

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all piping systems as shown on the Drawings and as specified herein. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. It is the CONTRACTOR'S responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and appurtenances, for a complete and functional system.

C. All pipe grades and elevations shown the Drawings are the pipe flow-line.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330523	Steel Casing, Boring and Jacking.
C.	Section 331300	Pressure Pipeline Testing and Disinfection.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 033055	Cast-in-Place Concrete Pipe
F.	Section 055000	Miscellaneous Metalwork.
G.	Section 099000	Protective Coating.
H.	Section 330526	Piping Identification Systems.
I.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
J.	Division 1	General Requirements.
K.	Division 2 and 5	Pipe Sections as applicable.
L.	Division 15	As applicable.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch).
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.

ANSI B31.1	ASME Code for Pressure Piping.
ANSI/AWS D1.1	Structural Welding Code.
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile for Strength.
ASTM A 325	Specification for Structural Bolts, Heat Treated 120/105 ksi Minimum Tensile Strength.
ASTM C 564	Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
ASTM D 792	Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
ASTM D 2000	Classification System for Rubber Products in Automotive Applications.
AWWA C207	Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
AWWA C606	Standard for Grooved and Shouldered Joints.
AWWA Manual M-11	Restrained Joint Harness.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

B. The CONTRACTOR shall submit complete shop drawings and certificates, and test reports, for all products and materials proposed to be used for all piping systems. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

C. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

D. The CONTRACTOR shall submit copies of welder's certificates to the ENGINEER.

1.4 QUALITY ASSURANCE

A. **General:** All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. **Tests:** Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. The CONTRACTOR shall assure tests are performed at no additional cost to the CITY.

C. **Welding Requirements:** Certificates of Compliance shall be supplied by the pipe fabricator for all welding procedures used to fabricate pipe and welding procedures shall be prequalified under the provisions of ANSI/AWS D1.1.

D. **Welder Qualifications:** All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent, local, approved testing agency not more than 6 months prior to commencing work on the pipeline. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

1.5 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is required, in order to obtain compliance for pipe fabrication and installation, the CONTRACTOR shall furnish such assistance at no additional cost to the CITY.

1.6 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

1.7 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and all other debris, shall be removed from the site. The entire piping system shall be left in a clean and functional condition.

PART 2 -- PRODUCTS

2.1 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 through 15 and as specified herein.

B. **Miscellaneous Pipes:** Miscellaneous pipes and fittings shall be in accordance with the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances" and as specified herein.

C. **Lining:** All requirements pertaining to thickness, application, and curing of pipe lining, shall be in conformance with the requirements of the applicable piping specifications and Section 099000, "Protective Coating," unless otherwise specified.

D. **Coating:** All requirements pertaining to thickness, application, and curing of pipe coating, shall be in conformance with the requirements of the applicable piping specifications, and Section 099000, "Protective Coating."

E. **Pressure Rating:** All piping systems shall be designed for the maximum expected pressure and test pressure as defined in Section 331300, "Pressure Pipeline Testing and Disinfection," or as shown on the piping schedule.

2.2 THREADED INSULATING CONNECTIONS

A. **General:** Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. **Materials:** Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.3 COUPLINGS

A. **Cast Couplings/Transition Couplings:** Flexible couplings for 4 inch through 12 inch pipe shall be ductile iron or steel, with ductile iron followers and Buna N gaskets, **APAC Style 341, Ford FC1 or FC3, or equal.** Cast transition couplings shall be **APAC Style 335, Ford FL2A, or equal.** The couplings shall have the manufacturer's factory fusion bonded epoxy coating and lining, and Type 304 stainless steel bolts and nuts.

B. **Rigid PVC Coupling:** Rigid couplings for 4 inch through 12 inch pipe shall be PVC High Deflection Stop Couplings and Closure couplings, **Certain Teed C900 HD Stop and Closure Coupling, or equal.**

C. **Sleeve-Type Couplings**

1. **Construction:** Sleeve-type couplings shall be provided for pipe 14 inch and larger, steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. The middle ring shall be not less than 1/4 inch in thickness and shall be either 5 or 7 inches long for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Bolts and nuts shall conform to the requirements of Section 055000, "Miscellaneous Metalwork." Buried sleeve-type couplings shall be epoxy-coated at the factory in accordance with Section 099000, "Protective Coating."

2. **Pipe Preparation:** The ends of the pipe, where specified or shown, shall be prepared for flexible couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, except for AC pipe, with outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe. For connections to existing AC pipe the tolerances will be established by the ENGINEER. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

3. **Gaskets:** Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall meet the following specifications:

   a. Color - Jet Black.

   b. Surface - Non-blooming.

   c. Durometer Hardness - 74 +/- 5.

   d. Tensile Strength - 1000 psi Minimum.

e. Elongation - 175 percent Minimum.

The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Product in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and use.

4. **Insulating Sleeve Couplings:** Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

D. **Flexible Joints:** Where harnesses are required for flexible sleeve-type couplings, they shall be in conformance with the Drawings. Hardware shall be stainless steel in conformance with Section 055000, "Miscellaneous Metals."

E. **Repair Clamps:** Repair clamps shall be full circle repair clamps, **APAC Series 431, 432, and 433; Ford F1, F2, or F3; or equal,** with ductile iron lugs and Type 304 stainless steel bands, rubber gasket, and T-Head stainless steel bolts and nuts. The repair clamp shall have the manufacturer's standard coatings and linings for the appropriate service use.

F. **Mechanical Compression Joints:** Mechanical compression joints shall have a synthetic SBR rubber body conforming to ASTM C 564 and shall have Type 302 stainless steel bands and clamps. They shall be manufactured by **Calder Couplings, Fernco, or equal.**

2.4 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

2.5 PRESSURE GAUGES

A. Pressure gauges shall be provided on each side of pressure reducing valves, and where shown on the Drawings.

B. Gauges shall be industrial quality type with stainless steel movement and stainless steel or alloy case, unless otherwise shown or specified, gauges shall have a 4-inch dial, 1/4 threaded connection, a Type 316 stainless steel snubber adapter, and a shut-off valve.

C. **Manufacturers or Equal:**

1. **Ashcroft Industrial Instruments (Dresser)**

2. **Foxboro/Jordan, Inc.**

3. **Duro Instrument, Corp., Series 100**

2.6 PIPE INSULATION

A. Domestic backflow preventers and appurtenances without an approved protective enclosure shall be insulated.

B. By-pass piping and appurtenances on Class 3, 4, 5, and 6 Fire Service Installations shall be insulated.

C. Insulation shall be a prefabricated foam insulation material with an all-purpose jacket. The minimum insulation thickness shall be 2-inches. The insulation shall be **Polycell Insulating Foam, or equal.**

D. The insulation shall be wrapped with a 2-inch wide minimum, 10 mil black pipe tape.

2.7 RUBBER LINK SEALS

A. Rubber link seals shall be modular rubber sealing elements, with non-metallic pressure plates and galvanized folds, **Thunderline "Link Seals," O-Z Electrical "Thruwall" and "Floor Seals," or equal.**

2.8 FLANGED COUPLING ADAPTORS

A. Flanged coupling adapters for pressure reducing stations shall be factory fusion bonded epoxy **Ford FFCA or FFCA-1, APAC 201 or 221, or equal.** Nuts and bolts shall be for ductile iron pipe.

PART 3 – EXECUTION

3.1 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in conformance with the requirements of the applicable Sections of Divisions 2 and 15 and with the manufacturer's printed recommendations. All coatings shall be in conformance with Section 099000, "Protective Coatings."

B. Where the grade or alignment of the pipe is obstructed by existing utilities and structures such as conduits, ducts, pipes, maintenance holes, or other utility facilities, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in conformance with the requirements and approval of the owners of such utilities and structures.

C. All pipe shall be stockpiled and stored in conformance with the manufacturer's printed recommendations.

D. **Fill Material or Trench Support:** Overexcavation fill material, bedding, and trench subgrade shall be compacted as specified in Section 312300, "Utility Earthwork," and graded to provide a uniform and continuous support beneath the pipe at all points.

- END OF SECTION -

SECTION 331102 - PVC PRESSURE PIPE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install 4 inch to 36 inch polyvinyl chloride (PVC) pressure pipe, and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 331300	Pressure Pipeline Testing and Disinfection.
C.	Section 330130	Sanitary Sewer and Storm Drain System.
D.	Section 055900	Ductile Iron Pipe.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
H.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

AASHTO	Standard for Highway Bridges.
ANSI/AWWA C104	Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
ANSI/AWWA C110	Standard for Ductile-Iron and Gray-Iron Fittings, 3-In. through 48-In., for Water and Other Liquids.
ANSI/AWWA C111	Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
ANSI/AWWA C153	Standard for Ductile-Iron Compact Fittings, 3-In. through 6-In., for Water and other Liquids.
AWWA C600	Installation of Ductile-Iron Water Mains and their Appurtenances.
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4-In. through 12-In., for Water Distribution.
AWWA C905	Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-In. through 36-In.

AWWA Manual M23 PVC Pipe - Design and Installation.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section, as specified in the referenced standards, and the following supplemental requirements:

1. Hydrostatic proof test reports.
2. Sustained pressure test reports.
3. Burst strength test reports.

B. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

1.5 QUALITY ASSURANCE

A. **Tests:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Section, and as specified in the referenced standards, as applicable.

B. The CONTRACTOR shall have said material tests performanced at no additional costs to the CITY. The ENGINEER shall have the right to witness all testing provided, that the CONTRACTOR'S schedule is not delayed for the convenience of the ENGINEER.

C. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the CITY. The additional samples shall be furnished at no additional cost to the CITY.

PART 2 – PRODUCTS

2.1 GENERAL

A. PVC pressure pipe, 4 inch through 12 inch and 14 inch through 36 inch shall conform to the applicable requirements of AWWA C900 and AWWA C905, respectively, and shall be subject to additional requirements specified herein.

B. All pipe material used for reclaimed water shall be purple such as **PW Purple Plus pipe as manufactured by PW Pipe, Purple Save Pipe as manufactured by J-M Manufacturing Company, Inc., Purple Centurion Pipe as manufactured by IPEX , or equal.**

C. All PVC pipe shall be continuously marked in conformance with the appropriate ASTM. All purple PVC pipe shall be continuously marked in accordance with the requirements of Section 330526, "Piping Identification Systems."

2.2 PIPE DESIGN

A. **General:** PVC pressure pipe shall be designed in accordance with the requirements of AWWA C900, or AWWA C905, as applicable, except that safety factors and surge pressure requirements of C900 shall be applied to all pipe, 4 inch through 36 inch. Pressure class shall be as shown on the Drawings, but in no case shall the dimension ratio be greater than 18 for C900 or 26 for C905 pipe. The pressure class for reclaimed water pressure pipe shall have a dimension ratio of 14 for C900 pipe or a dimension ratio of 18 for C905 pipe.

2.3 PIPE

A. The pipe shall be of the diameter and pressure class as specified or shown, furnished complete with rubber gaskets, and all specials and fittings shall be provided as required. The dimensions and pressure classes for Dimension Ratios for PVC pressure pipe with Cast-Iron Pipe Equivalent O.D.'s shall conform to the requirements of AWWA C 900, or AWWA C 905, as applicable.

B. **Joints:** All joints for the buried PVC pipe shall be an integral bell manufactured on the pipe employing a rubber ring joint. The bell shall be the same or greater thickness as of the pipe barrel.

C. **Joint Deflection:** Deflection at the joint shall not exceed 1.0 degrees for AWWA C905 or 1.5 degrees for C900 or the maximum deflection recommended by the manufacturer. No deflection of the joint shall be allowed for joints which are over-belled or not belled to the stop mark.

D. Bending of pipe shall not exceed recommendations of AWWA or manufacturers printed recommendations.

2.4 FITTINGS

A. Fittings shall be ductile iron and shall conform to the requirements of AWWA C 110 or AWWA C153 minimum Class 250. Fittings shall be mechanical joint.

B. Restrained joints shall be as approved in writing by the ENGINEER.

C. All fittings shall be lined and coated in accordance with the requirements of Section 05060 "Ductile Iron Pipe."

D. Each fitting shall be clearly labeled to identify its size and pressure class.

E. **Service Saddles and Tapping Sleeves:** All service saddles, and tapping sleeves shall be in accordance with the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

PART 3 – EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective materials from the site of the work.

B. Installation shall conform to the requirements of AWWA Manual M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 PIPE HANDLING

A. **Handling:** Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean and sanitary condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

3.3 STORAGE

A. Pipe shall be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution is to be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe shall be stored in such a way as to prevent sagging or bending and protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons. Pipe, fittings, or accessories improperly stored are subject to rejection by the ENGINEER.

3.4 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirements of Section 312300, "Utility Earthwork," and as specified herein.

3.5 INSTALLATION

A. Bell and spigot pipe shall be laid with the bell end pointing in the direction of laying. Pipe shall be set to grade in straight lines, taking care to avoid the formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable as determined by ENGINEER. At the end of each day's work, open ends of pipe shall be closed temporarily with water-tight, expandable type plugs.

B. Pressurized lines laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. Water lines shall be laid uphill on grades exceeding 10 percent.

C. Pipe shall be supported at its proper elevation and grade, care being taken to secure firm and uniform support. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the pipe bed, with recessed excavation to accommodate bells and joints. Anchors and supports shall be provided where necessary and where indicated on the Drawings for fastening work into place. Fittings shall be independently supported.

D. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's printed recommendations.

E. Pipe shall be cut by means of saws, power driven abrasive wheels or pipe cutters, which will produce a square cut. No wedge-type roller cutters will be permitted. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disc.

F. All necessary precautions shall be taken to prevent uplift or floating of the pipe prior to the completion of the backfilling operation. The CONTRACTOR shall assume full responsibility for any damage due to this cause and shall, at its own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

G. Each pipe elastomeric gasket joint shall be installed in conformance with the manufacturer's printed recommendations.

3.6 COPPER WIRE AND WARNING TAPE

A. Installation of copper wire, warning tape, and pipe identification shall conform to Section 330526, "Piping Identification Systems."

3.7 SERVICE CONNECTIONS

A. **Service Connections:** Service saddles or fittings for PVC pipe shall be used for all service connections on new pipeline installations. On existing PVC pipelines all service connections shall be tapping sleeves. Service saddles shall have a bearing area of sufficient width along the axis of the pipe, so that the pipe will not be distorted when the saddle is made tight. An internal shell cutter shall be used to drill through the corporation stop to minimize PVC shavings, retain the coupon, and reduce stress. **Single fluted shell cutters or twist drills will not be allowed.** Lubricate the cutting and tapping edges of the tool with cutting lubricant. Make the cuts slowly and use the follower very lightly. Do not force cutter through pipe wall. Shell cutter shall have sufficient throat depth to handle the heavy wall PVC pipe. Maximum outlet size permitted with service saddle is 2 inches.

B. Tapping sleeves and valves shall be used for all outlets greater than 2 inches in diameter. Tapping sleeves shall be assembled and installed in accordance with the manufacturer's printed recommendations and Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.8 TESTING AND DISINFECTION

A. Field testing and disinfection of all pressure pipe shall conform to the requirements of Section 331300, "Pressure Pipeline Testing and Disinfection."

- END OF SECTION -

SECTION 331200 - MISCELLANEOUS PIPING, VALVES, FITTINGS, AND APPURTENANCES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all exposed and buried piping, complete, including but not necessarily limited to small steel pipe, small valves, red brass pipe, copper tubing, solvent-welded PVC pipe, fittings, gaskets, bolts, insulating connections, and all such other specialties as required for a complete and operable piping system, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Division 2 and 5	Piping Sections.
B.	Section 331219	Fire Hydrants.
C.	Section 055000	Miscellaneous Metalwork.
D.	Section 099000	Protective Coating.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
ANSI/ASME B16.3	Malleable Iron Threaded Fittings, Classes 150 and 300.
ANSI/ASME B16.15	Cast Bronze Threaded Fittings, Classes 125 and 250.
ANSI/ASME B31.1	Power Piping, DoD Adopted.
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A 106	Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
ASTM A 325	Specification for Structural Bolts, Steel, Heat-Treated, 120/105 ksi minimum tensile strength.
ASTM B 43	Specification for Seamless Red Brass Pipe, Standard Sizes.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.

ASTM B 88	Specification for Seamless Copper Water Tube.
ASTM D 1785	Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D 2239	Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR). Based on Controlled Inside Diameter.
ASTM D 2737	Specification for Polyethylene (PE) Plastic Tubing.
AWWA C207	Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 inch through 144 inch.
AWWA C507	Standard for Ball Valves 6 In. Through 48 In. (150mm through 1200mm).
AWWA C 800	Standard for Underground Service Line Valves and Fittings.
AWWA Manual M 11	Steel Pipe - A Guide for Design and Installation.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1. Manufacturers product specifications and performance details shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 SMALL STEEL PIPE

A. Galvanized steel pipe shall conform to the requirements of ASTM A 53, and shall be Schedule 40 or 80. NPT fittings for galvanized steel pipe shall be of galvanized malleable iron.

2.2 POLYETHYLENE PLASTIC PIPE AND TUBING (FOR WATER SERVICES)

A. Polyethylene plastic pipe, for 1 inch Residential Joint Domestic/Fire Services only, shall be PE 3408 with SIDR 7, iron pipe size conforming to the requirements of ASTM D 2239, and a rating of 200 psi. Polyethylene plastic tubing, for 1 inch, 1-1/2 inch, and 2 inch services, shall be PE 3408 with SIDR 9, copper tubing size conforming to the requirements of ASTM D 2239, and a rating of 160 psi.

B. All joints connecting Polyethylene Plastic Pipe or Tubing shall utilize "Pack Joint Type" compression fittings.

2.3 BRASS PIPE

A. Brass pipe shall conform to the requirements of ASTM B 43. Fittings shall be of bronze conforming to the requirements of ASTM B 62 with threaded ends, conforming to ANSI/ASME B16.15.

B. Two inch brass street elbows, for Dead End and In-Line Blowoffs shall be **Jones 2619, Ford F84.77-G, or equal.**

2.4 COPPER TUBING

A. Copper tubing shall conform to the requirements of ASTM B 88 and shall be Type K, soft temper, joint free, for buried tubing; and hard-drawn joint free, for above-ground applications. All fittings connecting copper tubing shall be compression fittings.

2.5 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, SOLVENT-WELDED

A. PVC pipe shall be made from all new rigid unplasticized polyvinyl chloride and shall be Schedule 40 or 80, as specified, conforming to ASTM D 1785. Joints and fittings shall be of the same material as the pipe and shall be solvent-welded construction.

2.6 CORPORATION STOP VALVES

A. **Tapered Plug Type**

1. Tapered plug style valves shall be brass conforming to AWWA C800.

2. The connection joint to the service saddle shall be in conformance with AWWA C800 iron pipe thread.

3. The connection joint to the service lateral shall be a "Pack Joint Type" compression joint.

4. Tapered plug style valves on steel or ductile iron pipe shall utilize a threaded insulating bushing between the tapping outlet or service saddle on the water main and the stop valve.

B. **Manufacturers, or Equal**

1. Iron Pipe Sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	*n/a*	J-3404	F-1101-4

2. Copper Tubing sizes, 1", 1-1/2", and 2" service:

Size	Mueller	Jones	Ford
1"	n/a	J-3403	F-1100-4
1-1/2"	n/a	n/a	n/a
2"	n/a	n/a	n/a

C. **Ball Valve Type**

1. Ball valve style valves shall be brass conforming to AWWA C800.

2. The connection joint to the service saddle shall be in conformance with AWWA C800 iron pipe thread.

3. The connection joint to the service lateral shall be a "Pack Joint Type" compression joint.

4. Ball valve style valves on steel or ductile iron pipe shall utilize a threaded insulating bushing between the tapping outlet or service saddle on the water main and the stop valve.

D. **Manufacturers, or equal.**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	E-25029	J-1936	FB-1101-4

2. Copper tubing sizes, 1", 1-1/2", 2" services:

Size	Mueller	Jones	Ford
1"	P25028	J-1935	FB-1100-4
1 ½"	P-25028	J-1935	FB-1100-6
2"	P-25028	J-1935	FB- 1100-7

2.7 ANGLE METER STOP VALVES

A. Angle meter stop valves shall be a brass ball valve or brass angle meter valve with a 90-degree lock wing. The connection joint to the water service line shall be a "Pack Joint Type" compression joint.

B. **Manufacturers, or Equal**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	**n/a**	J-1962W	BA63-444W

2. Copper tubing sizes, 1", 1-1/2", and 2" services:

Size	Mueller	Jones	Ford
1"	P-24258	J-1963W	BA43-444W
1-1/2"	P-24276	J-1975W	BA43-666W
2"	P-24276	J-1975W	FV43-777W

2.8 METER ADAPTERS

A. Slotted meter adapters shall be used for piston meter sizes 1" and smaller when service lateral size is 1-1/2" or 2".

B. Manufacturers shall be **Ford A47 slotted adapter, Jones or equal.**

2.9 LOCKABLE BALL VALVES

A. Lockable ball valves for commercial services shall be a brass ball valve with iron pipe threads on both ends with padlock wings.

B. **Manufacturers, or equal.**

1. Female iron pipe threads both ends for turbine meter installation:

Size	Mueller	Jones	Ford
1"	B-20200	J-1900W	B11-444
1-1/2"	B-20200	J-1900W	B11-666
2"	B-20200	J-1900W	B11-777

2. Female iron pipe threads by meter swivel for piston meter:

Size	Mueller	Jones	Ford
1"	B-24351	n/a	BF13-444W
1-1/2"	B-24337	J-1912W	BF13-666W
2"	B-24337	J-1912W	B13-777W

2.10 POLYETHYLENE PIPE TUBING LINERS

A. Stainless steel liners shall be used with all compression fittings on polyethylene pipe and tubing.

B. **Manufacturers, or equal.**

1. Iron pipe sizes, 1" Residential Joint Domestic/Fire Service only:

Size	Mueller	Jones	Ford
1"	505142	J-2806	72

2. Copper tubing sizes, 1", 1-1/2", 2" services:

Size	Mueller	Jones	Ford
1"	504385	J-2805	52
1-1/2"	506139	J-2105	54
2"	506141	J-2805	55

2.11 TAPPING SLEEVES

A. Tapping sleeves shall be cast iron, mechanical-joint sleeves with a rated working pressure of at least 150 psi, stainless steel with stainless steel nuts and bolts, or steel, mortar lined and coated, with stainless steel nuts and bolts. Bolts and nuts on epoxy lined sleeves shall be Type 304 or 316 stainless steel.

B. Manufacturers, or equal

Pipe Type	APAC	Clow	Ford	Mueller	Tyler
Plastic	512 (14-30")	F-5205 (4-16")	FTSC* (14-30")	H-615 (4-12")	5-149
	512 (6-12")*	F 5207** (4-12")	FTSC (4-12")*	H-304 (14-24")	
Ductile Iron	512 (4-30")	F-5205 (4-16')	FTSC (4-30")	H-615 (4-24")	5-149
				H-304 (4-24")	
Asbestos Cement	512 (6-30) *	F-5207 (4-12") **	FTSC (14-30")* FTSS (SS)(4-12")	H-619 (4-12") H-304 (14-16")	5-349
Steel	504 (4-36")	--	FWS (4-16")		

* allowed only if the pipe is out of round and it is approved by Water Resources.
** for Class 100 pipe, 10" and 12", use the F-5205.

2.12 TAPPING OUTLETS

A. Tapping outlets for steel mortar-lined and coated pipe shall be designed and fabricated to comply with design procedures in AWWA Manual M-11. The tapping outlets shall be designed for the pressure rating of the pipeline to which they are attached, with a minimum rated working pressure of 150 psi.

B. Tapping outlets for mortar-lined and coated steel pipe shall be factory fusion bonded epoxy lined and coated steel in conformance with Section 099000, "Protective Coatings," with stainless steel nuts and bolts.

C. **Manufacturers for steel pipe, or equal:**

APAC	**Ford**
534	FWS

2.13 SERVICE SADDLES

A. Service saddles shall be bronze or stainless steel for use on plastic; bronze for use on asbestos cement ; and steel or iron for use on ductile iron pipe.

B. Service saddles will not be allowed on mortar lined and coated steel pipe. Tapping outlets shall be used on mortar-lined and coated steel pipe.

C. Service saddles shall be double strap type except for service saddles on plastic pipe.

D. The service tap on the service saddle shall have an AWWA C800 iron pipe thread.

E. **Manufacturers, or equal**

Pipe Type	APAC	Mueller	Jones	Ford
Asbestos Cement	113	BR 2B 0684 IP to BR 2B 1732 IP	J-979	202 B
Ductile Iron	102 to 103	DR 2A 0659 IP to DR 2A 1740 IP	**n/a**	202
Plastic PVC C900	**n/a**	H-13491 to H-13494	J-996	S-91
Plastic PVC C905	**n/a**	**n/a**	**n/a**	202 BS

2.14 WELD-O-LETS

A. For 1", 1-1/2", and 2" service connections to steel mortar lined and coated pipe use 3000#, forged steel, **Bonney Forge Co., "Weldolet," Allied Piping Products Co., "Branchlet; or equal.**

2.15 SANITARY SEWER LATERAL CONNECTIONS TO EXISTING MAINS

A. Lateral connections to existing vitrified clay pipe, PVC, and ductile iron pipe sanitary sewer mains shall be made using the "Tap-Tite" Method or the Saddle-Type Method with a sewer pipe saddle manufactured by **Sealtite, Romac, or equal.**

B. Lateral connections to existing ABS and PVC composite pipe shall be made with solvent welded saddle fittings in accordance with the manufacturer's printed recommendations.

2.16 SANITARY SEWER LATERAL CLEAN OUTS

A. Two-way Sanitary Sewer Clean outs on 4 inch sanitary sewer laterals shall be cast iron **ANACO,Two-Way Combination Clean-out; American Brass and Iron, Two-Way Clean-out fitting (Kelly); or equal.** Sanitary sewer cleanouts on 6 inch and larger pipe shall be a combination Wye and 1/8th bend, **ANACO; American Brass and Iron; or equal.**

2.17 AIR RELEASE VALVES

A. Air release valves shall be **Crispin P-Series, APCO 200 Series, or equal.**

2.18 THREADED INSULATING BUSHING

A. Male threaded by compression or slip insulating bushings of PVC shall be provided at CITY water meters.

2.19 WATER SAMPLING STATION

A. Water Sampling Station housing, base flange, internal valve and support and bolts will be supplied and installed by the CITY and paid for by the developer. The CONTRACTOR shall furnish all other products and materials required to install Water Sampling Stations and as shown on the Drawings.

2.20 PIPE SUPPORTS

A. All piping systems and pipe connections to equipment shall be properly supported to prevent undue deflection, vibration and stresses on piping, equipment and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1, except as supplemented or modified by this Section.

2.21 STOCK PARTS

A. Where not specifically shown or detailed use stock or production parts wherever possible. Such parts shall be new, of best commercial quality, designed and rated for the intended purpose.

2.22 PIPE FLANGES

A. **Flanges:** Where the design pressure is up to a maximum of 275 psi, flanges shall conform to either AWWA C207 Class E or ANSI B16.5 for 150-pound flanges. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207. Flanges for miscellaneous pipes shall be in accordance with the appropriate Specification Sections for these pipes.

B. **Blind Flanges:** Blind flanges shall be in accordance with AWWA C207, or with the appropriate Specification Sections for the various pipe types.

C. **Flange Coating:** All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. **Flange Bolts:** All bolts and nuts shall conform to Section 055000, "Miscellaneous Metalwork." Studs and bolts shall extend through the nuts a minimum of 1/4 inch. All-thread studs shall be used on all valve flange connections where space restrictions preclude the use of regular bolts. Flange bolts for fire hydrant installations shall be in accordance with Section 331219, "Fire Hydrants."

E. **Insulating Flange Sets:** Insulating flange sets shall be provided where shown. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulated flanges shall have bolt hole diameter 1/4 inch greater than the bolt diameter. Insulating sleeves shall be 1/32 inch thick NEMA LI-1 (1989) Grade G-10 fiberglass epoxy. Washers shall be 5/32 inch thick NEMA LI-1 (1989) Grade G-10 fiberglass epoxy. Steel washers, bolts and nuts shall be in accordance with ASTM A 325. Insulating gaskets shall be 1/8 inch thick full-face Neoprene-faced phenolic.

F. **Insulating Flange Manufacturers, or Equal:**

1. **JM Red Devil, Type E**
2. **Maloney Pipeline Products Co.**
3. **PSI Products, Inc.**

G. **Flange Gaskets:** Gaskets for flanged joints shall be full-faced, 1/16 inch thick compressed sheets of aramid fiber base, with nitrile binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to 11, and pressures to 1000 psig. Blind flanges shall have drop-in gaskets. Drop-in gaskets shall be 1/4 inch smaller than the inside edge of the bolt holes. Ring gaskets will not be allowed.

2.23 SEWER LATERAL BACKFLOW PREVENTOR

A. Sanitary sewer lateral backflow preventors shall be as manufactured by National Diversified Sales, Lindsay, CA, Flow Control Inc., Burbank, CA, or equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. **Small Steel Pipe:** Galvanized steel pipe shall be coated as specified in Section 099000, "Protective Coating."

B. **Plastic Pipe:** PVC pipe joints shall be solvent-welded in accordance with the manufacturer's printed instructions.

C. **Couplings:** Pipe couplings shall be installed in strict accordance with the manufacturer's printed recommendations, using the correct style coupling and gasket as appropriate.

D. **Gaskets for Flanged Joints:** Gaskets shall be in accordance with the requirements of Section 331100, "Piping, General."

E. **Insulating Connections:** All insulating connections shall be installed in accordance with manufacturer's printed instructions and Section 331100 "Piping, General." Care shall be exercised to prevent damage to insulating fittings while making up the joints.

F. Unless otherwise shown on the Drawings, service saddles, tapping sleeves, tapping outlets and Weld-O-Lets shall be field coated equal to the existing pipe coating.

G. Tapping of any existing main shall be coordinated with the ENGINEER. A minimum of 48 hours notice shall be given to the ENGINEER before installation. The ENGINEER will be present during the tapping process. After completion of the tap the Coupon ("Cookie") shall be given to the ENGINEER.

H. Plastic water service pipe or tubing shall be installed joint free between the corporation stop valve and angle meter stop valve.

I. Water Sampling Stations shall be installed at the locations shown and in conformance with the Drawings.

J. Installation of warning tape and copper wire shall be in conformance with Section 330526, "Piping Identification Systems."

- END OF SECTION -

SECTION 331213

BACKFLOW PREVENTION ASSEMBLIES AND PRESSURE REDUCING VALVES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install Backflow Prevention Assemblies and small and large Pressure Reducing Valves, complete and operable including accessories and, where designated operators, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A.	Section 331100	Piping, General.
B.	Section 331200	Miscellaneous Piping, Valve Fittings, and Appurtenances.
C.	Section 331215	Valves, General.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A.	CITY OF LIVERMORE	Backflow Preventer Ordinance.
B.	**Commercial Standards:**	
	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings.
	ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
	AWWA C 510	Double Check Backflow-Prevention Assembly.
	AWWA C 511	Reduced-Pressure Principle Backflow-Prevention Assembly.
	USC	University of Southern California, Manual of Cross-Connection Control.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62.

PART 2 – PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall contact the Water Resources Division for a list of the approved Backflow Prevention Assemblies, and testing services.

B. All exposed, manually operated butterfly valves shall have operators with position indicators.

2.2 BACKFLOW PREVENTION ASSEMBLIES

A. Backflow Prevention Assemblies shall be as follows:

1. For low hazard Industrial/Commercial Fire Services: Double-Check Detector-Check Backflow Prevention Assembly.

2. For high hazard Industrial/Commercial Fire Services: Reduced-Pressure Detector-Check Backflow Prevention Assembly.

3. For low hazard domestic or non-CITY owned irrigation: Double Check Backflow Prevention Assembly.

4. For high hazard domestic or non-CITY owned irrigation: Reduced-Pressure Backflow Prevention Assembly.

5. For CITY owned irrigation: Reduced-Pressure Backflow Prevention Assembly.

2.3 INSULATED ENCLOSURES

A. Insulated enclosures are required for Backflow Prevention Devices 2 inches and smaller. Insulated enclosures shall be an above ground fiberglass rock enclosure by **Hot Box- Hot Rok, , Dekorra Products LLC, or equal**, and as shown on the Drawings.

2.4 PRESSURE REDUCING VALVES

A. Small pressure reducing valves (2 inch and smaller)

1. **General:** Small Pressure Reducing Valves, 2 inches and smaller, shall be of the spring-loaded diaphragm type with a pressure rating not less than 250 psi, with bronze body, nickel alloy or stainless steel seat, and threaded ends. Each valve shall be furnished with built-in or separate strainer and union ends.

2. **Manufacturers, or Equal:**

a. **Mueller Company**

b. **Watts Regulator Company**

c. **Wilkins Regulator**

B. Large pressure reducing valves (4 inch and larger)

1. The CONTRACTOR shall purchase all large pressure reducing valves 4 inches and larger from the Water Resources Division. The CONTRACTOR shall provide all required connections and fittings.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. All Backflow Prevention Assemblies and Pressure Reducing Valves shall be installed in accordance with the manufacturer's printed recommendations, as required by the CITY'S Backflow Prevention Ordinance, and applicable codes and regulations.

B. **Valve Accessories:** Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly.

C. Backflow Prevention Assemblies shall be installed in potable and recycled water lines where required by City of Livermore Backflow Prevention Ordinance, Title 17 California Code of Regulations, applicable codes or regulations, or wherever there is any danger of contamination, and where shown on the Drawings.

D. Backflow Prevention Assemblies shall be installed in the location shown on the Drawings and in conformance with the CITY'S Backflow Prevention Ordinance, Title 17 California Code of Regulations, and City Standard Detail.

E. Backflow Prevention Assemblies shall be tested by an approved testing service prior to putting the assemblies into service. The CONTRACTOR shall contact the City's Water Resource Division for a list of approved testing services. All costs of testing shall be at the CONTRACTOR'S expense.

F. Insulated enclosures for backflow prevention assemblies 2 inches and smaller shall be installed as required and in conformance with the manufacturer's printed recommendations and as shown on the Drawings.

G. The CONTRACTOR shall install all CITY supplied large Pressure Reducing Valves in accordance with manufacturer's printed recommendations.

- END OF SECTION -

SECTION 331215 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish, install, and test all valves and all appurtenant work, complete and operable as shown on the Drawings and as specified herein. Where buried valves are shown, the CONTRACTOR shall furnish and install valve boxes to grade, with covers, sleeves, and valve extensions.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets.
B.	Section 055000	Miscellaneous Metalwork.
C.	Section 099000	Protective Coating.
D.	Section 331100	Piping, General.
E.	Division 1	General Requirements.
F.	Divisions 2 and 15	As applicable.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Valve Testing:** Unless otherwise specified, each valve body shall be tested in conformance with the appropriate AWWA Standard for the specific type of valve being used.

B. **Bronze Parts:** Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62.

PART 2 – PRODUCTS

2.1 VALVES

A. **General:** The CONTRACTOR shall furnish all valves, valve-operating units, stem extensions and other accessories as shown or specified. All valves shall be new and of current manufacture. Where buried, all valves shall be provided with valve boxes and covers and valve extensions as required.

B. **Valve Flanges:** The flanges of valves shall be in accordance with Section 331100, "Piping, General."

C. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

D. **Protective Coating:** Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves, as well as the exterior surfaces of all valves, shall be coated as specified in Section 099000, "Protective Coating."

E. All unburied manual operators shall have handwheels.

F. All buried valves shall have operating nuts, valve boxes and other features as shown on the Drawings. Stem extensions shall be provided when valve is more than 8 feet deep.

G. **Bolts and Nuts:** All nuts and bolts on valve flanges and supports shall be in accordance with Section 055000, "Miscellaneous Metalwork."

H. **Valve Traffic Boxes and Covers:** Traffic boxes and covers shall be as specified in Section 034800, "Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets."

PART 3 – EXECUTION

3.1 VALVE INSTALLATION

A. **General:** All valves, operating units, stem extensions, valve boxes and accessories shall be installed in accordance with the manufacturer's printed instructions and as shown and specified. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access:** All exposed valves shall be installed to provide easy access for operation, removal and maintenance and to avoid conflicts between valve operators, structural members, or piping.

C. All valves shall be handled in a manner to prevent any injury or damage to any part of the valve. All joints shall be thoroughly cleaned and prepared prior to installation. All valves shall be installed so that the valve stem is plumb and valve is in the location shown on the Drawings.

D. Prior to installation of any valve the CONTRACTOR shall operate each valve and, as necessary, adjust stem packing to ensure proper operation.

- END OF SECTION -

SECTION 331216 - GATE VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install gate valves, 4 inch to 12 inch, complete and operable, including but not necessarily limited to operators, epoxy lining and coating, and appurtenant work, as shown on the Drawings and as specified herein. Unless otherwise shown or specified, all shut-off valves 12 inches and smaller shall be Gate Valves.

B. All manual shutoff valves over 12 inches shall be Butterfly Valves in accordance with Section 331217, "Butterfly Valves."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Section 331217	Butterfly Valves.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA C509	Standard for Resilient-Seated Gate Valves for Water and Sewerage Systems.
AWWA C550	Standard for Protective Epoxy Interior Coating for Valves and Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 GATE VALVES

A. **General:** All gate valves shall be resilient-seated, of the inside screw type. Valves shall be capable of being repacked under line pressure. All ferrous surfaces of the valves shall be factory fusion bonded epoxy lined and coated, as specified, in conformance with AWWA C550 and Section 099000, "Protective Coating" for exterior coating.

B. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

C. Resilient-seated gate valves conforming to AWWA C509 shall be provided. Resilient-seated gate valves shall have cast iron bodies with flanged or mechanical joint ends, elastomer-coated cast iron

wedge/disc, flanged bonnet, bronze stem, O-ring seals, and operators with handwheel or square nut, unless otherwise shown.

D. **Manufacturers, or Equal:**

1. **American Flow**

2. **M and H No. 4067, Kennedy 1500, Clow**

3. **Mueller A-2370**

PART 3 -- EXECUTION

2.3 INSTALLATION

A. All gate valves shall be installed in accordance with AWWA Standards and the manufacturer's printed recommendations, and in accordance with the applicable provisions of Section 331215, "Valves, General."

- END OF SECTION -

SECTION 331217 - BUTTERFLY VALVES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install manually-operated full body butterfly valves, complete and operable, including epoxy lining and coating, appurtenances, operators, and accessories as shown on the Drawings and as specified herein. Unless otherwise shown or specified, all shutoff valves 14 inches and larger shall be Butterfly Valves. Wafer style Butterfly Valves will not be allowed.

B. All manual shut-off valves 12 inches and smaller shall be Gate Valves in conformance with Section 331216, "Gate Valves."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Section 331216	Gate Valves.
D.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/AWWA C504	Standard for Rubber-Seated Butterfly Valves.
AWWA C550	Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificate of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 BUTTERFLY VALVES

A. **General:** Butterfly valves shall conform to ANSI/AWWA C504 subject to the following requirements. Valves shall be of the size shown. Flanged valves shall be a 150-pound class B type valve drilled with a 125-pound bolt pattern and unless otherwise shown, may be either short-bodied or long-bodied. When flanged valves are installed on the Recycled Water System or on the Potable Water System where the working pressure exceeds 150 psi, the valves shall be a 250-pound class type valve drilled with a 125-pound bolt pattern and unless otherwise shown , may be either short-bodied or long-bodied. Mechanical Joint Ends are allowed except when using PVC C900 DR14 and C905 DR18 pipe. Shaft seals shall be designed for use with standard split-V type packing, or other acceptable seal. The interior passage of butterfly valves shall not have any obstructions or stops. The rubber seat shall be positively clamped or bonded into the disc or body of the valve. Cartridge-type seats will not be allowed. All interior ferrous surfaces of valves shall be factory applied epoxy lined in conformance with AWWA C550. Exterior ferrous surfaces of valves exclusive of the

flange faces, shall be factory applied epoxy in conformance with Section 099000, "Protective Coating" for exterior coating.

B. **Elastomers:** All elastomers used in valves shall be made of EPDM synthetic polymers that are specifically developed for their chemical resistance. EPDM elastomers are to be used in both the gate valves and butterfly valves.

C. **Manual Operators:** Operators shall conform to ANSI/AWWA C504, subject to the following requirements. Unless otherwise shown, all unburied manually-operated butterfly valves shall be equipped with a handwheel and position indicator. Buried valves shall be equipped with a 2 inch square operating nut. All operators shall be side mounted.

D. **Manufacturers, or Equal:**

1. **Kennedy Valve/M&H/Clow**

2. **Mueller/Pratt**

PART 3 – EXECUTION

3.1 INSTALLATION

A. The installation of all butterfly valves shall be in accordance with Section 331215 "Valves, General."

B. All buried butterfly valves shall be oriented so that the operating nuts are on the side of the water main closest to the curb.

C. Where butterfly valves are connected to a "Tee" or "Cross" fitting, a 12-inch spool shall be installed between the fitting and the valve. An adaptor (FLGxMJ) is required between the valve and the pipe when PVC C-900 DR14 and PVC C905 DR18 pipe are used.

D. Where butterfly valves are installed with PVC C-900 DR14 and PVC C905 DR18 pipe, an adaptor (FLGxMJ) is required on both sides of the valve.

E. All exposed butterfly valves shall be installed with a coupling that can be used in removing the complete valve assembly without dismantling the valve or operator.

- END OF SECTION -

SECTION 331218 - CHECK VALVES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment and labor necessary to furnish and install all check valves in the types and sizes shown and specified, complete and operable, including epoxy lining and coating as appropriate, appurtenances and accessories, as shown on the Drawings and as specified herein.

B. All valves on Fire Service Installations shall be Factory Mutual approved or Underwriters Laboratories listed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 099000	Protective Coating.
B.	Section 331215	Valves, General.
C.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ANSI/ASME B1.20.1	Standard for Pipe Threads, General Purpose.
ANSI B16.1	Standard for Cast Iron Pipe Flanges and Flanged Fittings
ASTM A126	Specifications for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
ASTM B 61	Specifications for Stream or Valve Bronze Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 148	Specifications for Aluminum-Bronze Sand Castings.
AWWA C508	Standard for Swing-Check Valves for Waterworks Service, 2-In Through 24-In, NPS.
AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants.
FM	Factory Mutual Engineering of Research Corp.
UL	Underwriters Laboratories Inc. Standards.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 SWING CHECK VALVES (3 INCH AND LARGER)

A. **General:** Swing check valves 3 inch or larger for general service shall be of the outside lever and spring or weight type, in accordance with AWWA C508, unless otherwise specified below, full-opening; designed for a water-working pressure of 250 psi unless otherwise shown, and shall have a flanged cover piece to provide access to the disc. All ferrous surfaces of valves shall be factory fusion bonded epoxy lined and coated in conformance with AWWA C550 and Section 099000, "Protective Coating."

B. **Body:** The valve body and cover shall be of cast iron conforming to ASTM A 126, with flanged ends conforming to ANSI B 16.1, or mechanical joint ends, as shown.

C. **Disc:** The valve disc shall be of cast iron, ductile iron, or bronze conforming to ASTM B 62.

D. **Seat and Rings:** The valve seat and rings shall be of bronze to conforming ASTM B 62 or B 148, or Buna-N.

E. **Hinge Pin:** The hinge pin shall be of bronze or stainless steel.

F. **Manufacturers, or Equal:**

1. **Mueller Company**
2. **Kennedy Valve**
3. **Hersey**

2.2 SWING CHECK VALVES (2-1/2 INCH AND SMALLER)

A. **General:** Swing check valves in sizes 2-1/2 inch and smaller shall be suitable for a water pressure of 300 psi. They shall have screwed ends, unless otherwise shown, and screwed caps.

B. **Body:** The valve body and cap shall be of bronze conforming to ASTM B 61 and with threaded ends conforming to ANSI/ASME B1.20.1.

C. **Disc:** Valves shall have bronze discs.

D. **Hinge Pin:** The hinge pins shall be of bronze or stainless steel.

E. **Manufacturers, or Equal:**

1. **Ford**
2. **Mueller**
3. **Stockham**

2.3 DOUBLE-LEAF CHECK VALVES

A. **General:** Double-leaf check valves shall be of the wafer-type designed to fit between ANSI B16.1 flanges for 125-pound rating. The check valve leaves shall be spring-loaded. Flow from one direction shall cause the valve to open, and upon valve shutoff, the spring shall shut the valve leaves before reverse flow starts and at a point of zero velocity, for non-slam closure. The spring-tension of each valve shall be designed for the individual operating condition.

B. **Body:** The valve body shall be of cast iron with integrally-cast seat, rated for minimum 150-psi working pressure. All ferrous surfaces of valves shall be factory fusion bonded epoxy lined and coated in conformance with AWWA C550 and Section 099000, "Protective Coating."

C. **Leaves:** The leaves shall be of bronze, aluminum bronze, or ductile iron, revolving on stainless steel or monel hinge pins with retainers.

D. **Seat:** The valves shall have resilient seats for bubble-tight shut-off. The seat rings shall be firmly attached to the body or disc by compression-molding or similar acceptable method.

E. **Springs:** The springs shall be of Type 316 stainless steel, or Inconel.

F. **Manufacturers, or Equal:**

1. **APCO 900 Series**
2. **TRW Mission**
3. **VAL-MATIC**

2.4 DETECTOR CHECK VALVES

A. Detector check valves shall conform to the requirements of PART 2 – "Products" of this Section herein, except that valves shall be provided with a full-faced rubber clapper seal and an elevated bypass meter. The elevated bypass shall be comprised of a shutoff valve, check valve, and either a magnetic turbine or positive displacement meter. The bypass pipe shall be either copper or brass pipe. When the pressure loss through the bypass exceeds a preset amount, the valve automatically opens, allowing unrestricted flow.

B. **Manufacturers, or Equal:**

1. **Mueller A-2132-6 (4"-10")**
2. **Hersey**

PART 3 -- EXECUTION

3.1 GENERAL

A. All valves shall be installed in accordance with provisions of Section 331215, "Valves, General."

- END OF SECTION -

SECTION 331219 - FIRE HYDRANTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install fire hydrants, complete and operable including all appurtenances and accessories, as shown on the Drawings and as specified herein.

B. All valves on fire hydrant Installations shall be in conformance with 331216, "Gate Valves."

C. All valves on Fire Service laterals shall be Gate Valves for laterals 8 inch and less and Butterfly Valves for laterals larger than 8 inches.

D. In the California Water Service Area the CONTRACTOR shall contact California Water Service Company for their requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 331300	Pressure Pipeline Testing and Disinfection.
B.	Section 099000	Protective Coating.
C.	Section 330526	Piping Identification System.
D.	Section 331215	Valves, General.
E.	Section 331216	Gate Valves.
F.	Section 331217	Butterfly Valves.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA C503	Standard for Wet-Barrel Fire Hydrants.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 -- PRODUCTS

2.1 WET-BARREL FIRE HYDRANTS

A. **Construction:** Fire hydrants shall be of the wet-barrel type, in accordance with AWWA C 503. Fire hydrants shall have a factory supplied buried section of mortar lined ductile iron and a solid spool between 6 inches and 12 inches long connected to the hydrant head. When located in residential areas, the hydrant shall have one 4-1/2 inch steamer connection and one 2-1/2 inch hose connection. For commercial and industrial areas, hydrants shall have one 4-1/2 inch steamer connection and two 2-1/2 inch hose connections. The hydrant inlet shall be 6 inches in diameter. The hose and steamer

connections shall be provided with cast iron caps and metal chains. Hose connection threads shall be American National Fire Hose Threads. The hydrants shall be tested to 300 psig and they shall be suitable for a working pressure of 150 psig. All interior and exterior surfaces of fire hydrant, spool, and bury shall be coated in accordance with Section 099000, "Protective Coating."

B. Fire hydrants shall have a minimum weight of 190 pounds.

C. **Manufacturers:**

a. Hydrants for residential areas shall be:

1. **Clow Corporation East Bay Series, Model 5; or Ranger 900 Series, Model 950.**

2. **Long Beach Iron Works, Inc. East Bay Type, Model 611; or Anacapa 600 Series, Model 614.**

b. Hydrants for commercial/industrial areas shall be:

1. **Clow Corporation Ranger 900 Series, Model 960.**

2. **Long Beach Iron Works, Inc. Anacapa 600 Series, Model 615.**

2.2 BOLTS AND NUTS

A. See notes on City Standard Detail W-1C.

2.3 IDENTIFICATION

A. All valve lids on potable and reclaimed water systems shall be identified in conformance with Section 330526, "Piping Identification Systems." Valve lids in reclaimed water systems shall be factory purple.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All fire hydrants shall be installed in strict accordance with the manufacturer's printed recommendations, AWWA Standards, and all applicable codes, and the applicable provisions of Section 331215, "Valves, General." Any deviation from installation requirements or specified location is subject to prior approval of the Fire Department.

B. All fire hydrant lateral gate valves shall be flanged by mechanical joint valves. All fire hydrant buries shall be installed with a concrete thrust block. Fire hydrant flange bolts shall be installed with the bolt end facing up. Slotted on offset spools shall be used only when approved by the ENGINEER.

C. The 4-1/2 inch steamer connection shall be installed perpendicular to the street. The fire hydrant lateral must be installed perpendicular to the water main.

D. Hydrants, fire hydrant valve lids and guard posts shall be painted in accordance with Section 099000 "Protective Coatings."

3.2 TESTING

A. Testing for fire flows shall be in accordance with Section 331300, "Pressure Pipeline Testing and Disinfection."

- END OF SECTION -

SECTION 331233 - WATER METERS

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install water meters, radio read meter transceiver units and other appurtenances in the CITY'S water service area, complete and operable as shown on the Drawings and specified herein.

B. In the CITY'S Water Service Area the CONTRACTOR shall purchase all meters, radio read meter transceiver units and other appurtenances from the CITY. The CONTRACTOR shall provide all water meter parts and accessories not purchased with the CITY'S water meter packages.

C. All meters, radio read meter transceiver units and appurtenances purchased from the CITY shall be inventoried and controlled by the CONTRACTOR. Any meters found to be defective must be returned to the CITY for exchange. Damaged meters will not be eligible for exchange.

D. In the California Water Service Area the CONTRACTOR shall contact California Water Service Company for their requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets.
B.	Division 1	General Requirements.
C.	Divisions 2 and 15	As applicable.

1.3 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 WATER METER STRAINERS

A. Separate strainers shall be purchased from the CITY for all turbine meter installations 3 inches and larger.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The CONTRACTOR shall assemble and install all equipment specified herein, in strict accordance with the manufacturer's printed instructions, and as shown on the Drawings.

B. Care shall be taken to protect the meters from damage, dirt or foreign material.

C. For all turbine meters 3 inches and larger the CONTRACTOR shall install a separate strainer purchased from the CITY.

- END OF SECTION -

SECTION 331300 - PRESSURE PIPELINE TESTING AND DISINFECTION

PART 1 – GENERAL

1.1 REQUIREMENT

A. The CONTRACTOR shall furnish all materials, equipment, and labor to perform and complete flushing and testing of all pipelines and appurtenant piping, and disinfection of all pipelines and appurtenant piping for potable and recycled water, complete, including conveyance of test water from CITY-designated source to point of use and all disposal thereof, and as specified herein.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

AWWA B300	Standard for Hypochlorites.
AWWA C651	Standard for Disinfecting Water Mains.

1.3 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided or all products and materials proposed to be used under this Section.

B. A testing schedule, including proposed plans for water conveyance, control, disposal, and disinfection shall be submitted in writing to the ENGINEER for review a minimum of 72 hours before testing is to start.

1.4 TESTING AND DISINFECTION

A. The CONTRACTOR will test the pipe for pressure and disinfection. All testing will be conducted in the presence of the ENGINEER.

PART 2 – PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. All test equipment, chemicals for chlorination, temporary valves or assemblies, bulkheads, or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER'S review. No materials shall be used which would be injurious to the piping system or its proposed function.

B. Chlorine for disinfection shall be in the form of sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

C. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of AWWA B300.

PART 3 – EXECUTION

3.1 GENERAL

A. The CITY will furnish the water for the first hydrostatic test, and for the first disinfection test up through the first flushing sequence. All water for any re-testing shall be paid for by the

CONTRACTOR. The CONTRACTOR shall make all necessary provisions for conveying the water from the CITY-designated source to the points of use.

B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the ENGINEER.

C. Bacteriological testing will be performed by the ENGINEER. Results of the bacteriological testing must meet the requirements of the State Department of Health Services.

3.2 HYDROSTATIC TESTING OF PIPELINES

A. Connections for testing of pipe shall be in conformance with the Drawings. Backflow assemblies used to comply with City Standard Detail W-7 shall be tested and approved by a certified backflow assembly tester. A passing test report on the backflow assembly shall be provided by the CONTRACTOR to the CITY before the assembly is used.

B. The CONTRACTOR shall test all pipelines as a single unit, or in sections if approved by the ENGINEER. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 72 hours. The test may be made by closing new valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. Unless approved by the ENGINEER testing shall not be performed against existing system closed valves. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. The CONTRACTOR shall provide sufficient temporary air release assemblies to allow for evacuation of all entrapped air in each pipe unit or section to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air release assemblies are open during filling.

C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air release assemblies at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline unit or section thereof has been filled, it shall be allowed to stand under pressure for at least 24 hours to allow the pipe concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.

D. The hydrostatic test shall consist of holding the test pressure on the pipeline for a period of 4 hours. The test pressure for pipelines shall be 100 percent of the pipe pressure class. The test pressure for piping shall be as shown or specified, measured at the lowest point of the pipeline unit or section being tested. All visible leaks shall be repaired in a manner acceptable to the ENGINEER.

E. **Maximum Leakage**

1. The maximum allowable leakage for pressure pipelines shall be in accordance with the following formula:

   Design Basis

   $$L = \frac{ND\sqrt{P}}{7400}$$

   Where: L = allowable leakage (gal/hr)
   N = number of joints in the tested line
   D = nominal diameter of pipe (in.)
   P = average test pressure (psi)

   Pipe with welded joints, flanged joints, and service lateral pipe shall have no leakage.

2. In the case pipelines fail to pass the prescribed leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines.

3.3 DISINFECTING PIPELINES

A. **General:** All potable and recycled water pipelines shall be disinfected. Pipeline disinfection operations shall be performed at the Primary Jumper location in conformance with the Drawings.

B. **Chlorination:** Hypochlorite shall be used to chlorinate the piping system in accordance with the requirements of AWWA C651 and as modified by this Section. Care shall be taken to prevent chlorine solution in the pipeline being disinfected from flowing back into the pipeline supplying the water. Any one of the following 2 methods as listed in the AWWA standard (brief summary of two methods as modified below) can be used for the initial disinfection; however, if the pipeline fails a bacteriological test, it must be disinfected again by the slug method:

   1. The continuous feed method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. The potable water shall be chlorinated so that after a minimum 24 hour holding period in the main there will be a free chlorine residual of not less than 25 mg/l.

   2. The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l.

C. **Retention Period:** Chlorinated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours but disinfecting solution higher than 50 mg/l shall not remain in the pipeline for more than 96 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/l.

D. **Valve Disinfection:** During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.

E. **Final Flushing:** After the retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the existing system. The CONTRACTOR shall apply a reducing agent to the water to thoroughly neutralize the chlorine residual remaining in the water prior to disposal of the water. The CONTRACTOR will be solely responsible for the proper disposal of all water used for the disinfection process in accordance with regulatory agency requirements. With prior approval by the ENGINEER, the CONTRACTOR may discharge the heavily chlorinated water into the sanitary sewer system in lieu of the above neutralization requirements.

F. **Bacteriological Testing:** Pipe shall be left for a period of 24 hours after final flushing before any sample is collected. A sample, or samples will be collected by the ENGINEER and will be tested for bacteriological quality in accordance with the requirements of the State Department of Health Services. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated until acceptable results are obtained. All lab costs for subsequent bacteriological testing after the initial test shall be borne by the CONTRACTOR. All lab costs for initial bacteriological testing will be paid by the CITY. All costs for water used for flushing, and re-filling of the pipeline after failure of a bacteriological test shall be borne by the CONTRACTOR.

3.4 CONNECTIONS TO EXISTING SYSTEM

A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a sodium hypochlorite solution in conformance with the requirement of AWWA C651, except that the solution shall be 5 percent, before they are installed.

3.5 TESTING

A. Fire flow testing of fire service lines and fire hydrant laterals will be tested by the CITY and approved by the ENGINEER prior to acceptance of the pressure pipeline installation.

- END OF SECTION -

SECTION 333102 - ABS AND PVC COMPOSITE PIPE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite pipe gravity sanitary sewers, and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

B. The pipe shall consist of two concentric extruded thermoplastic tubes integrally braced across the annulus. The resultant annular space shall be filled with inert material such as light-weight portland cement concrete to provide continuous support between the inner and outer tubes.

C. All sanitary sewer lines in industrial areas shall be vitrified clay pipe in conformance with Section 333106 "Vitrified Clay Pipe."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333104	Small ABS and PVC Nonpressure Pipe.
D.	Section 333106	Vitrified Clay Pipe.
E.	Section 331100	Piping, General.
F.	Section 330526	Piping Identification Systems.
G.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
H.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM D 2564	Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
ASTM D 2680	Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 GENERAL

A. Composite Pipe shall be continuously and permanently marked with the manufacturer's name, pipe size, ASTM Specification Number, type of plastic, and extrusion code, including date and location of manufacture.

2.2 PIPE DESIGN

A. Composite Pipe shall be manufactured and provided to meet the pipe strength classifications as shown on the Drawings and in accordance with ASTM D 2680, but in no case shall have a pipe stiffness less than 200 lb/in/in.

2.3 PIPE AND FITTINGS

A. Composite Pipe and fittings shall conform to the requirements of ASTM Designation D 2680, and shall have either solvent cement joints or elastomeric gasket joints.

B. "WYE" fittings are required on all new mains. Connections to existing mains shall be made by Tap-tite method or solvent welded, banded, saddle "wye" fittings.

C. Sanitary sewer clean outs shall be in conformance with in Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

D. Sewer lateral connections shall accommodate solid wall pipe, PVC or ABS as specified in Section 333104, "Small ABS and PVC Nonpressure Pipe."

2.4 SOLVENT CEMENT JOINTS

A. Cement for ABS joints shall be MEK containing a minimum of 20 percent by weight of dissolved ABS and shall comply with ASTM D 2564.

B. Cement for PVC joints shall comply with ASTM D 2564 except that the minimum resin content shall be 16 percent and minimum viscosity shall be 3500 cP.

2.5 ELASTOMERIC GASKET JOINTS

A. Composite Pipe with gasketed joints shall comply with ASTM D 2680 and shall be manufactured with a socket configuration which will prevent improper installation of the gasket and will ensure that the gasket remains in place during the joining operation. The gasket shall be manufactured from a synthetic elastomer containing not less than 50 percent by volume of first-grade synthetic rubber.

PART 3 – EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective material from the site.

3.2 BEDDING

A. Pipe bedding shall conform to the requirements of Section 312300, "Utility Earthwork."

3.3 PIPE LAYING

A. Composite Pipe shall be installed in conformance with the requirements of the pipe manufacturer's recommendations and the provisions of this Section.

B. Bell and spigot pipe shall be laid with the bell end at the lowest point with the spigot end pointing in the direction of the flow.

C. Handling of the pipe shall be done with care to insure that the pipe is not damaged in any manner during storage, loading, transit, unloading, and installation.

D. The pipe shall be laid to the lines and grades shown on the Drawings and the sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for jointing, the bedding for the pipe shall be checked for firmness and uniformity of surface.

E. Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the CONTRACTOR for safe and efficient installation. All pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

F. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or will produce ragged, uneven edges.

G. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar plugs will not be permitted.

H. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered shall be furnished by the CONTRACTOR at its own expense.

I. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.4 FIELD JOINTING

A. **General:** The pipe shall not be deflected either vertically or horizontally in excess of the manufacturer printed recommendations.

B. When pipe laying is not in progress, the open ends of the pipe shall be closed by approved means to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of the ENGINEER, the trench conditions or weather are unsuitable for such work.

C. **Solvent-Weld Joints:** Each solvent-weld pipe joint shall be sealed with solvent cement in conformance with the requirements of ASTM D 2680 and the manufacturer's printed recommendations. The spigot and socket shall be wiped clean before the solvent cement is applied. After insertion of the spigot end into the solvent weld bell end the inside surfaces shall be wiped clean of excess cement.

D. **Gasketed Joints:** Each gasketed pipe joint shall be joined with a lock-in elastomeric gasket. The gasket and the gasket seal inside the bell shall be wiped clean before the gasket is inserted. At this time a liberal amount of lubricant shall be applied to the gasket and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall

then be forced into the bell to complete the joint. On field cut spigot ends, the outer pipe wall shall be chamfered with a file to remove all burrs and rough spots.

E. All Composite Pipe ends which are not factory sealed shall be sealed with an approved epoxy sealing material prior to installation.

3.5 SANITARY SEWER CLEAN OUTS

A. Sanitary Sewer cleanouts shall be installed in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.6 TESTING

A. Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333104 - SMALL ABS AND PVC NONPRESSURE PIPE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all 4 inch to 15 inch polyvinyl chloride (PVC) solid wall nonpressure pipe; 4 inch and 6 inch acrylonitrile-butadiene-styrene (ABS) solid wall nonpressure pipe; and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein. All 4 inch and 6 inch ABS nonpressure pipe will only be allowed for sanitary sewer laterals.

B. All sanitary sewer lines in industrial areas shall be vitrified clay pipe in conformance with Section 333106, "Vitrified Clay Pipe."

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333102	ABS and PVC Composite Pipe.
D.	Section 333106	Vitrified Clay Pipe.
E.	Section 033050	Utility Cast-in-Place Concrete.
F.	Section 331100	Piping, General.
G.	Section 330526	Piping Identification Systems.
H.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
I.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

ASTM C 425	Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
ASTM D 1784	Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
ASTM D 1869	Specification for Rubber Rings for Asbestos-Cement Pipe.
ASTM D 2241	Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR-Series).
ASTM D 2321	Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
ASTM D 2751	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe.

ASTM D 3034	Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Tests:** All materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.

B. All costs of such inspection and tests shall be borne by the CONTRACTOR.

C. The pipe shall be subjected to the specified hydrostatic strength tests, flexure tests, and crushing tests. The crushing tests shall be made on samples taken from the center of full-length sections of pipe.

PART 2 – PRODUCTS

2.1 GENERAL

A. All solid wall pipe shall be continuously and permanently marked in conformance with the appropriate ASTM.

B. The CONTRACTOR shall also require the manufacturer to mark the date of extrusion on the pipe.

C. Pipe shall be of the pipe pressure class as shown on the Drawings.

2.2 PIPE

A. All PVC pipe shall be joined by compression joints unless otherwise specified or as shown on the Drawings, and shall conform to the following requirements:

1. Polyvinyl chloride pipe (PVC) shall conform to the requirements of ASTM D 3034, and shall have a maximum SDR of 35 and a minimum pipe stiffness of 46 psi. Material for PVC pipe shall conform to the requirements of ASTM D 1784 for Class 12454-B or 12454-C as defined therein.

2. Flexible rubber rings for elastomeric gasket joints for PVC pipe and fittings shall conform to the requirements of ASTM D 1869.

B. ABS solid wall pipe shall conform to the requirements of ASTM D 2751, and shall have a maximum SDR of 35, or a minimum SDR of 23.5 with solvent welded joints.

2.3 FITTINGS

A. All fittings including wyes and sanitary sewer lateral cleanouts for PVC pipe shall conform to the requirements of ASTM D 2241. The ring groove and gasket ring shall be compatible with PVC pipe ends.

B. ABS solid wall fittings shall be of the same SDR rating as the pipe and provided with solvent welded joints.

C. The strength class of the fittings shall be not less than the strength class of any adjoining pipe.

2.4 BEDDING MATERIAL

A. Unless otherwise specified or shown, all material used for pipe bedding shall conform to the requirements for bedding in Section 312300, "Utility Earthwork."

2.5 FLEXIBLE COUPLINGS

A. Flexible couplings used for repairs shall be rubber, full-circle, clamp-on type conforming with ASTM C 425 and provided with 2 stainless steel band screw-clamps to secure the coupling tightly to entering and exiting pipes. All screw-clamp hardware shall be Type 304 or Type 316 stainless steel. Rubber material shall be suitable for use on sewage systems.

2.6 LATERAL CONNECTIONS TO SANITARY SEWER

A. Service lateral connections to new sewers shall be made with wye fittings, installed as the sewer pipe is laid.

B. Service lateral connections to existing sewers shall be made by "Tap-Tite" method, or with approved "Sealtite" type saddle fittings which utilize neoprene gasket seals and stainless steel bands.

C. Sanitary sewer cleanouts, shall be in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

PART 3 – EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage shall be performed in the presence of the ENGINEER, and shall be subject to its approval before acceptance. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective materials from the site of the WORK.

B. Installation shall conform to the requirements of ASTM D 2321 and to the supplementary requirements or modifications specified herein. Wherever the provisions of this Section and the requirements of ASTM D 2321 are in conflict, the more stringent provision shall apply.

C. The CONTRACTOR shall perform the deflection 'mandrel' test as specified in Section 330130 "Sanitary Storm Drain Sewer System Leakage Testing." If the amount of allowable pipe deflection is exceeded, the CONTRACTOR shall uncover the pipe and shall improve the quality of the Pipe Zone backfill material and/or compaction to the extent that the allowable pipe deflection is not exceeded.

3.2 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to the requirements of Section 312300, "Utility Earthwork," and as specified herein.

3.3 PIPE LAYING

A. The pipe shall be installed in conformance with the requirements of ASTM D 2321, as specified herein and as shown on the Drawings. The pipe sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for connecting joints, the bedding for the pipe shall be checked for firmness and uniformity of surface.

B. Proper implements, tools, and facilities as recommended by the pipe manufacturer's printed instructions shall be provided and used by the CONTRACTOR for safe and efficient execution of the work. All pipe, fittings, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

C. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe or will produce ragged, uneven edges.

D. Installation of pipes in prepared trenches shall start at the lowest point, with the spigot ends pointing in the direction of flow.

E. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

F. Adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR at its own expense.

G. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.4 PIPE HANDLING

A. Handling of all pipe shall be done with care to insure that the pipe is not damaged in any manner during storage, transit, loading, unloading, and installation.

B. Pipe shall be inspected both prior to and after installation in the trench and all defective lengths shall be rejected and immediately removed from the working area.

3.5 PVC FIELD JOINTING

A. Each pipe elastomeric-gasket joint shall be installed in conformance with the manufacturer's printed recommendations.

B. The ring and the ring seat inside the bell shall be wiped clean before the gasket is inserted. At this time a thin film of lubricant shall be applied to the exposed surface of the ring and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the ring to complete the joint.

C. The pipe shall not be deflected either vertically or horizontally in excess of the printed recommendations of the manufacturer.

D. When pipe laying is not in progress, the open ends of the pipe shall be closed to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of the ENGINEER, the trench conditions or weather are unsuitable for such work.

3.6 ABS FIELD JOINTING

A. ABS pipe shall be solvent welded in strict accordance with the manufacturer's printed recommendations.

3.7 FITTINGS

A. All fittings shall be installed utilizing standard installation procedures. Fittings shall be lowered into trench by acceptable means without damage to the fittings. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to insure a sound and proper joint.

3.8 SANITARY SEWER CLEANOUTS

A. Sanitary sewer cleanouts shall be installed in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

3.9 TESTING

A. Field testing of pipe shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333106 - VITRIFIED CLAY PIPE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all vitrified clay pipe and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 331100	Piping, General.
E.	Section 330526	Piping Identification Systems.
F.	Section 331200	Miscellaneous Piping, Valves, Fittings, and Appurtenances.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Commercial Standards:**

- -	National Clay Pipe Institute - "Clay Pipe Engineering Manual."
AASHTO	Standard Specifications for Highway Bridges.
ASTM C 12	Practice for Installing Vitrified Clay Pipe Lines.
ASTM C 301	Test Methods for Vitrified Clay Pipe.
ASTM C 425	Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
ASTM C 700	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
ASTM C 828	Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Testing at Manufacturer's Plant:** All pipe shall be subject to a hydrostatic pressure test and a 3-edge bearing test at the manufacturer's plant. The ENGINEER may select at random and test as specified one length of pipe for each 1000 feet or fraction thereof to be installed for the test as specified in ASTM C 301. The cost of pipe and the test shall be borne by the CONTRACTOR. Pipe

will be acceptable under the test requirements specified herein when all test specimens conform to the test requirements. Should any of the test specimens fail to meet the test requirements, the manufacturer will be allowed to retest 2 additional specimens for each specimen that failed, and the pipe shall be acceptable only when all the retest specimens meet the strength requirements.

B. **Inspection of Materials:** All pipe and fittings shall be true, circular, and concentric with the barrel of the pipe, cut off on a plane at right angles to the longitudinal axis of the pipe. At no point shall the thickness of the shell of the extreme outer end of the spigot be less in thickness than the shell of the main body of the pipe. Socket ends shall be square with the longitudinal axis and shall be true, circular, and concentric with the barrel of the pipe. All pipe shall be subject to inspection at the place of manufacture. The CONTRACTOR shall notify the ENGINEER, in writing, of the manufacturing starting date not less than 14 days prior to the start of any phase of the pipe manufacture.

C. All pipe and fittings shall have smooth interiors and shall be free from injurious cracks, checks, blisters, broken extremities, or other imperfections.

D. The following imperfections in the barrel or socket of a pipe or fitting will be considered injurious and cause for rejection:

1. A single crack in the barrel of the pipe or fitting extending through the entire thickness, regardless of the length of such crack; a single crack which extends through 1/5 of the barrel thickness and is over 3 inches long; any surface fire crack which is more than 1/32-inch wide at its widest point.

2. Lumps, blisters, pits, or flakes on the interior surface of a pipe or fitting.

3. When spigot or bell of the pipe varies from a true circle more than 3 percent of its nominal diameter.

4. Any piece broken from the spigot end which extends through the barrel.

5. Tramp clays, grog, or other foreign matter which is fused permanently to the exterior or interior surface of the pipe or fittings.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

A. All pipe and fittings shall conform to the following requirements:

Clay pipe and fittings shall be extra strength, unless otherwise shown and shall conform to the requirements of ASTM C 700.

B. Service Laterals:

1. Service laterals in new sewers shall be installed using wye-type fittings.

2. Service laterals into existing sewers shall be in conformance with Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

C. Sanitary sewer cleanouts shall conform to the requirements of Section 331200, "Miscellaneous Piping, Valves, Fittings, and Appurtenances."

2.2 VITRIFIED CLAY PIPE

Vitrified clay pipe shall be extra strength pipe and shall be in accordance with ASTM C 12 and C 700.

2.3 JOINTS

Joints in vitrified clay pipe shall be made up using a factory-made bell and spigot compression joint for all pipe diameters. For connections to existing VCP up to 12 inches in diameter, a synthetic rubber collar with stainless steel shear ring and stainless steel take-up clamps, bolts and nuts, meeting the requirements of ASTM C 425, may be used.

PART 3 – EXECUTION

3.1 GENERAL

A. The VCP pipe shall be constructed to the alignment and grade shown. The grade line shown on the profile is the invert of the pipe. The excavation shall be made a sufficient distance below the grade line to allow for the placing of the sewer pipe and embedment. Should the trench be excavated to a depth greater than required, the CONTRACTOR shall refill such excess over-excavation according to the requirements of Section 312300, "Utility Earthwork."

B. Installation of warning tape shall conform to Section 330526, "Piping Identification Systems."

3.2 INSTALLATION OF PIPE

A. Installation of pipe shall be in accordance with ASTM C 12. Pipe laying shall proceed upgrade starting at lowest point with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench and immediately before joining the pipe, the ends of the pipe to be joined shall be cleaned and the gasket lubricated, all in accordance with the pipe manufacturer's written instructions. Assembly of the pipe length shall be in accordance with the recommendations of the manufacturer of the type of joint used. All special tools and appliances required for joining the pipe shall be provided by the CONTRACTOR. When cutting or machining of the pipe is necessary, only tools and methods recommended in writing by the pipe manufacturer and reviewed by the ENGINEER shall be employed.

B. The CONTRACTOR shall take all necessary precautions to prevent excavated or other foreign material from getting into the pipe during the laying operations. At all times, when laying operations are not in progress and at the close of the day's work, the ends of the pipe in the trench shall be closed with appropriate bladders, to prevent entry to animals and foreign materials. Plywood will not be allowed.

C. All necessary precautions shall be taken to prevent uplift or floating of the pipe prior to the completion of the backfilling operation. The CONTRACTOR shall assume full responsibility for any damage due to this cause and shall, at its own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

3.3 TESTING

Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 333900 - PRECAST CONCRETE MAINTENANCE HOLES

1.1 THE REQUIREMENT

The CONTRACTOR shall provide all materials, equipment, and labor to furnish and install all prefabricated maintenance holes complete with frame, cover, pipe connections, and cast-in-place or prefabricated base, and all other appurtenances complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 333100	Reinforced Concrete Pipe (PVC-Lined).
C.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 036000	Grout.
F.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Field Drop Water Inlets.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. **Commercial Standards:**

ASTM A 48	Specification for Gray Iron Castings.
ASTM C 150	Specification for Portland Cement.
ASTM C 478	Specification for Precast Reinforced Concrete Manhole Sections.

1.4 CONTRACTOR SUBMITTALS

Certificates of Compliance: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

PART 2 – PRODUCTS

2.1 MATERIALS

A. **Maintenance Holes:** Maintenance holes shall be constructed of concentric precast reinforced concrete sections in accordance with ASTM C 478. Precast concrete sections shall be manufactured by a process that will produce a dense, homogeneous concrete section of first quality. Steps or rungs will not be allowed in maintenance holes. The sections shall have a minimum wall thickness of 4 inches for 48-inch diameter sections and a minimum wall thickness of 6 inches for 60 inch diameter sections. Cement used in manufacturing the sections for sanitary sewer maintenance holes shall be Type V portland cement as specified in ASTM C 150. Maintenance hole sections shall be sealed using preformed joint material as specified in Section 034800, "Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets" and grout as specified in Section 036000, "Grout." All maintenance holes shall have reinforced cast-in-place or reinforced precast concrete bases and formed channels

with inverts to match the adjoining pipes. Maintenance hole sections shall be designed for a minimum of HS-20 traffic loading plus earth loads. Calculate earthload with a unit weight of 130 pcf.

B. Maintenance holes in sewers constructed of PVC lined reinforced concrete pipe shall be provided with compatible PVC lining from the top of the base up to and including 1/2-inch minimum of the cast iron frame. PVC-lining shall conform to the requirements of Section 333100, "Reinforced Concrete Pipe (PVC-lined)."

C. **Castings:** Castings for maintenance holes frames and covers shall be non-rocking and shall conform to the requirements of ASTM A 48, Class 30B. Cast iron covers and frames shall be heavy duty traffic type, 24 inches in diameter, with a curved blind pickhole, and embossed lettering for "Storm Sewer" or "Sanitary Sewer," as applicable. Frame and cover shall be designed for HS-20 traffic loading. For installations in unimproved areas, cover and frames shall be bolted. All castings shall be thoroughly cleaned and subject to a hammer inspection after which they shall be twice dipped with an asphalt or coal tar coating applied at a temperature of not less than 290 degrees F. nor more than 310 degrees F.

D. **Castings Suppliers, or Equal:**

1. **Phoenix P-1002** for field installations.
   Phoenix P-1090 for street and paved installations.

2. **D & L Supply Company A-1024.**

E. **Water Stops:** Plastic pipe connections to precast concrete maintenance holes and cast-in-place bases shall also be sealed using a premolded elastomeric waterstop material.

F. All connections to precast concrete maintenance holes shall be made with non-shrink grout.

PART 3 – EXECUTION

3.1 INSTALLATION

A. All precast concrete maintenance holes shall be installed in strict conformance with the manufacturer's printed instructions on a well compacted foundation as specified in Section 312300, "Utility Earthwork."

B. Maintenance hole frames and covers shall not be set to final grade until the pavement has been completed. Frame and cover shall be set and adjusted to grade after final paving. The street cut in asphalt concrete pavement shall be circular and paving around the maintenance hole shall be in accordance with the Drawings. Openings in maintenance holes shall be protected from construction loads, debris, and unauthorized entry.

C. Maintenance hole sections shall be set so as to be vertical with sections in true alignment. The joint of the previously set section shall be clean and covered with preformed joint sealant before the next section is placed. The joint material shall be installed in accordance with manufacturer's printed recommendations.

D. No pipe ends shall protrude into the maintenance hole. No bell section of the pipe shall be placed into the maintenance hole wall.

E. Structure backfill and compaction shall be as specified in Section 312300, "Utility Earthwork."

3.2 TESTING

A. Testing of precast concrete maintenance holes shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 334100 - CORRUGATED POLYETHYLENE NONPRESSURE PIPE (HDPE)

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install 12 inch to 36 inch corrugated polyethylene nonpressure pipe with all necessary fittings and coupling systems and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Inlets.
F.	Section 331100	Piping, General.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **State of California (Caltrans) Standards:**

Section 61	Culvert and Drainage Pipe Joints.
Section 64	Plastic Pipe.

B. **Commercial Standards:**

AASHTO M 294	Specification for Corrugated Polyethylene Pipe, 36 in. Diameter.
ASTM D 2412	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel - Plate Loading.
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins (R 1985).
ASTM D 3350	Specification for Polyethylene Plastics Pipe and Fittings Materials.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 QUALITY ASSURANCE

A. **Testing:** All materials testing shall be based upon applicable ASTM Test Methods referenced herein for the materials specified. All costs of such manufacturing inspections and tests shall be borne by the CONTRACTOR.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Corrugated polyethylene pipe shall be smooth interior wall Type S and shall be as specified in AASHTO M 294, except as otherwise specified herein. Corrugated polyethylene pipe shall be manufactured from high density polyethylene (HDPE) virgin compounds.

1. HDPE compounds used in the manufacture of corrugated polyethylene pipes shall conform to the following cell classifications as provided in ASTM D 3350:

Property	Cell Classification
Density	3
Melt index	2[(a)], 3 or 4
Flexural modulus	4, 5 or 6
Tensile strength	4, 5 or 6
Environmental stress crack resistance	1, 2, or 3
Hydrostatic design basis	0, 1, 2, 3, or 4
Ultraviolet stabilizer	C[(b)]

(a) The melt index for cell class factory 2 material used to manufacture pipe shall not be greater than 0.6. Rotationally-molded couplings and end fittings may be produced from material compounds having a melt index cell classification of one.

(b) HDPE resin shall contain not less than 2 +/- 1/2 percent carbon black ultraviolet stabilizer.

B. The residue from ignition of the HDPE compounds shall not exceed 30 percent as determined by ASTM D 2584, except that the muffle furnace temperature shall be 450 +/- 25 degrees C. (840 +/- 45 degrees F.)

2.2 PIPE THICKNESS, STIFFNESS AND UNIT WEIGHT

A. Wall thickness of Type S corrugated polyethylene pipe shall be the thickness of the inner liner measured between corrugation valleys.

B. The pipe stiffness shall be determined in accordance with ASTM D 2412. Pipe stiffness shall be determined for 3 test specimens for each manufactured run. Minimum pipe stiffnesses and wall thickness shall be as follows:

Pipe Diameter (in.)	Minimum Wall Thickness (in.)	Minimum Pipe Stiffness (psi)
12"	0.035	50
15"	0.035	42
18"	0.050	40
24"	0.050	34
30"	0.050	28
36"	0.050	22

The minimum pipe unit weight shall meet the requirements of Table 2 of Section 64-1.03 "Pipe Thickness, Stiffness and Unit Weight" of the Caltrans Standard Specifications.

C. The pipe unit weight shall be computed as the average weight per foot of length determined from 3 test specimens, taken from each manufactured run. Each test specimen for pipes 24 inches in diameter and less shall be a minimum length of 2 diameters. The length of each test specimen for pipes larger than 24 inches in diameter shall be one diameter or a maximum of 36 inches, whichever is less. The weight of pipe specimens shall be determined with any suitable weighing device accurate to 0.10 pound.

2.3 JOINTS

A. The joint shall be bell and spigot design and shall include a rubber gasket meeting the requirements of ASTM F-47.

Fittings used in the system shall not reduce or impair the overall integrity or function of the pipe line. Fittings may be either molded or fabricated Common Corrugated fittings including in-line joint such as tees, wyes, and end caps. Unless otherwise specified, fittings shall be installed using a joint configuration meeting the requirements of cell Class 335420C as defined and described in ASTM D3350. Only fittings supplied or recommended by the manufacturer shall be used.

B. Water tightness shall be attained by the use of approved durable, high quality, resilient joint materials designed to perform the intended function. These materials shall be neoprene expanded rubber or sheet rubber gaskets, "O" ring rubber gaskets, butyl rubber base joint sealant, or other approved resilient materials. Watertight joints shall be tested in accordance with Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

PART 3 – EXECUTION

3.1 GENERAL

A. All laying, jointing, testing for defects and for leakage, shall be performed in the presence of the ENGINEER. All material found during the progress to have defects will be rejected and the CONTRACTOR shall promptly remove such defective material from the site of the WORK.

3.2 PIPE HANDLING

A. Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

3.3 INSTALLATION

A. Pipe shall be laid and jointed in accordance with the manufacturer's printed recommendations and the following provisions in order to be suitable for the purpose intended.

B. Necessary facilities shall be provided for lowering and properly placing the sections of pipe in the trench.

C. The pipe shall be laid to line and grade with the sections closely jointed.

D. Every precaution shall be taken to prevent flooding the pipe trench before backfilling operations.

E. New pipe shall be connected to existing or new drainage facilities as shown on the Drawings.

3.4 CONNECTIONS

A. Connections of HDPE to existing structures and pipes shall be as follows:

1. Connections to cast-in-place structures shall include a water-stop at mid-wall of the structure.

2. Connections to pre-cast structures shall include a water-stop at mid-wall of the structure, and opening shall be filled with cement grout in conformance with Section 036000 "Grout."

3. Connections to existing HDPE pipe shall be made with a premium split-coupling saddle tee.

4. Connections to existing PVC shall be made with a PVC saddle with a HDPE/SDR 35 PVC adaptor.

5. Connections to existing DIP shall be made with a DIP tap and heat shrink material around the joint. Heat shrink material shall be supplied by the HDPE pipe manufacturer.

6. Connections to existing RCP shall be as shown on the Drawings, except that the PCC concrete encasement around the RCP shall be extended to cover the HDPE a point 6 inches to 12 inches beyond the RCP sleeve.

3.5 TESTING

A. Testing of corrugated polyethylene non-pressure pipe shall conform to the requirements of Section 330130 "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 334102 - REINFORCED CONCRETE PIPE

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all reinforced concrete pipe and all appurtenant work, complete and operable, including all connections as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 312300	Utility Earthwork.
B.	Section 330130	Sanitary Sewer and Storm Drain System Leakage Testing.
C.	Section 333900	Precast Concrete Maintenance Holes.
D.	Section 033050	Utility Cast-in-Place Concrete.
E.	Section 034800	Precast Concrete Vaults, Utility Boxes, and Storm Water Field Drop Inlets.
F.	Section 331100	Piping, General.
G.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

ASTM C 76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 150	Specification for Portland Cement.
ASTM C 443	Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.
ASTM C 596	Test Method for Drying Shrinkage of Mortar Containing Portland Cement.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used in this Section.

PART 2 – PRODUCTS

2.1 PIPE MATERIALS

A. **Reinforced Concrete Pipe:** Reinforced concrete pipe shall conform to the requirements of ASTM Designation C 76. Cement shall conform to ASTM C150, Type II. Pipe shall be bell and spigot having O-ring rubber gaskets conforming to ASTM C 443 retained in a groove on the spigot end. All reinforcement shall be circular. **Elliptical reinforcing will not be allowed.**

B. **Cement Mortar:** Cement mortar for structures or pipe connections shall consist of a mixture of portland cement, sand, and water. Mortar shall be composed of one part of cement and 2 parts of clean, well-graded sand of such size that will pass a No. 8 sieve. Cement and sand shall first be combined in the proper proportions, and then thoroughly mixed with the required amount of water.

C. Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar will not be allowed.

D. Concrete material shall conform to the requirements of Section 033050, "Utility Cast-in-Place Concrete."

E. **Admixtures:** No admixture shall be used in mortar unless otherwise specified or accepted in writing by the ENGINEER.

2.2 PIPE DESIGN

A. Reinforced concrete pipe shall be manufactured and provided to meet the pipe strength classifications as shown on the Drawings and in accordance with ASTM C 76, but in no case shall be less than Class III for Wall "B" or Wall "C." Class I and II pipe will not be allowed.

B. Wall "A" pipe will not be allowed

PART 3 – EXECUTION

3.1 PIPE LAYING

A. Installation of pipes in prepared trenches shall start at the lowest point, with the spigot ends pointing in the direction of flow.

B. Pipe shall have a minimum laying length of approximately 8 feet, except for closure and other special pieces as approved by the Engineer. The length of the incoming and outgoing concrete pipe at each structure shall not exceed 4 feet.

C. Care shall be used to make sure that the bottom of the pipe is in contact with the bottom of the trench for the full length of each section.

D. **Excavation:** Bell holes shall be excavated at each joint to provide full length barrel support of the pipe and to prevent point loading at the bells.

E. **Pipe Laying:** Unless otherwise required, all pipe shall be laid straight between the changes in alignment and at uniform grade between changes in grade.

F. **Rubber Gasket Joints:** The rubber gasket joint shall be made by properly lubricating the rubber gasket with a suitable vegetable compound soap before it is placed in the groove at the spigot end. The gasket shall be stretched over the spigot end of the pipe and carefully seated in the groove, with care taken to equalize the stress in the gasket around the circumference of the joint. The gasket shall not be twisted, rolled, cut, crimped, or otherwise injured or forced out of position during the closure of the joint. A feeler gauge shall be used to check the position of the rubber gasket after the joint has been assembled. Where a joint placement is found to be improper, the tested pipe section shall be removed, the gasket checked for damage, a new gasket installed, if necessary, the pipe re-laid and the gasket placement rechecked.

G. Pointing and bonding mortar at pipe connections to structures shall be plastic and of such consistency that it will readily adhere to the pipe and structure.

3.2 TESTING

A. Testing shall conform to the requirements of Section 330130, "Sanitary Sewer and Storm Drain System Leakage Testing."

- END OF SECTION -

SECTION 344105 - SIGNAGE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all materials, equipment, and labor necessary to furnish and install all roadside signs, street name signs, and City/private property off-street signs, and all appurtenant work, complete in place, as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A.	Section 033050	Utility Cast-In-Place Concrete.
B.	Division 1	General Requirements.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. **Federal Specifications and Standards:**

United States Department of Transportation, Manual of Uniform Traffic Control Devices

595-A	Federal Standard

B. **City of Livermore:**

1. Sign Ordinance
2. Zoning Ordinance

C. **State of California (Caltrans) Standards:**

1. Standard Specifications:

Section 56	Signs.

2. Standard Plans
3. Traffic Manual

D. **Commercial Standards:**

ASTM C 653	Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed,) by the Hot-Dip Process.
USA	Underground Service Alert.

1.4 CONTRACTOR SUBMITTALS

A. **Certificates of Compliance:** Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

1.5 UTILITY LOCATIONS

A. The CONTRACTOR'S attention is called to the fact that utilities are present in the work areas. It is the CONTRACTOR'S responsibility to notify the utility companies having facilities in the project work areas at least 48 hours prior to beginning WORK to accurately locate said utilities before beginning of underground work. Utilities may be notified by contacting USA, Underground Service Alert, at (800) 642-2444.

B. For utilities not marked by USA, such as irrigation mains and laterals or on site services, the CONTRACTOR shall contact the property owner for assistance in locating said facilities.

C. The CONTRACTOR shall be responsible for repairing, at his own cost, any damage to utilities or irrigation facilities encountered during construction.

1.6 PRIVATE PROPERTY SIGNS

A. All private property signs are subject to approval by the City of Livermore Planning Division and shall be in conformance with the Zoning Ordinance, the Sign Ordinance, and all other City of Livermore regulations.

PART 2 -- PRODUCTS

2.1 SIGNS

A. **Roadside Signs:** Roadside signs shall be of the type as shown on the Drawings in accordance with the Caltrans Traffic Manual unless as otherwise noted on the drawings. Signs shall conform to Section 56, "Signs" of the Caltrans Standard Specifications and the Caltrans "Approved Sign Specification Sheets" as modified by this Section.

B. **Sign Plates:** Sign Plates shall be 0.080 gage aluminum alloy. Sign message shall be made using engineering grade sheeting **3M or equal**. Type N markers shall be made using high intensity reflective sheeting **3M or equal**.

C. **Street Name Signs:** Street names and size of signs shall be as shown on the Drawings. Sign background shall be reflective green with white lettering.

D. **City/Private Property Off-Street Signs:** City/private property off-street signs shall have message and size of sign as shown on the Drawings.

E. All signs in street right-of-way shall have "COL" and installation date etched or stamped on back of sign with 1/4" letters at lower right corner.

2.2 POSTS

A. **Roadside Signs, Street Name Signs, and City Off-Street Signs:**

1. All posts for signs installed on City property or within the public right of way shall be square formed steel tube, telescoping metal breakaway type, **Unistrut Telespar Sign Support System or equal**, of the size and dimensions as shown on the Drawings and as specified herein.

2. All posts shall be painted green and electrically powder coated except the sleeve and anchor which shall be galvanized. The color shall be green in conformance with Federal Standard 595-A, color number 14109 (Dark Limit V).

3. Tubing shall be 12 gage strip steel, structural quality, conforming to ASTM A-570 Grade 33.

4. Galvanized tubing shall be 12 gage strip steel, structural quality, conforming to ASTM A 446 Grade A; hot-dipped galvanized with a 1.25-ounce zinc coat, interior and exterior, conforming to ASTM C 653 coating designation G90; and the corner welds shall be zinc coated after scarifying operations.

2.3 HARDWARE

A. **Roadside, Street Name, and City Off-Street Signs:** Hardware for signs installed on City property or within the public right of way, shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal.** Drive rivets to be **Unistrut TL 3806 or equal.**

B. **Street Name Sign Installation on Street Lights:**

1. The cantilever bracket supports for street name signs installed on round street light standards shall conform to the requirements of **SIGNFIX Cantilever Sign System or equal.**

2. For sign blanks up to 20 inches in length with a maximum area of 2 square feet use **SIGNFIX Stainless Steel Mini Cantilever Brackets** with 5/8-inch 0.030 gauge stainless steel band and buckle **BAND-IT or equal.**

3. For sign blanks up to 42 inches in length with a maximum area of 6 square feet, use **SIGNFIX V-Back Aluminum Cantilever Brackets** with 3/4-inch 0.030 gauge stainless steel band and buckle **BAND-IT or equal.**

PART 3 -- EXECUTION

3.1 GENERAL

A. All sign locations on City property must be inspected and approved by the ENGINEER prior to installation. The CONTRACTOR shall notify the ENGINEER no later than 48 hours prior to the start of the scheduled sign installation.

B. The locations of all Off-Street signs must be approved by the Planning Division prior to start of installation of the signs.

C. All reference markings made by the CONTRACTOR shall be done with spray chalk and shall be removed by the CONTRACTOR after installation of the signs.

D. Roadside signs shall be installed 6" behind 5' monolithic sidewalk, and 18" behind face of curb where there is a separated sidewalk, 10' sidewalk or no sidewalk unless otherwise noted on plans.

E. All utilities damaged by the CONTRACTOR shall be repaired and replaced by the CONTRACTOR at its expense to the satisfaction of the ENGINEER and the owner of the utility.

3.2 INSTALLATION OF POST

A. **Roadside, Street Name, and City Off-Street Signs:** Installation of roadside, street name, and City off-street signs installed on City property shall be at the locations shown on the Drawings or as specified herein.

1. Installation shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal.**

2. The square end of the anchor shall not be modified or pointed, but shall be capable of being driven into the ground by the use of an approved driving cap. The driving cap shall be

reusable and shall allow the square anchors to be manually driven into the ground with the aid of a sledge hammer or a jack hammer without deforming the anchor or the driving cap.

3.3 INSTALLATION IN EXISTING SIDEWALK

A. For signs installed in existing sidewalks a 6-inch core shall be drilled, the anchor installed, the the core filled with Class B portland cement concrete in conforming to Section 033050, "Utility Cast-In-Place Concrete." Existing surfacing other than portland cement concrete shall be replaced in kind, with the replacement matching the existing product, depth, and pattern, to the satisfaction of the ENGINEER. The sleeve shall be protected such that concrete will not enter the inside of the square post.

3.4 INSTALLATION OF SIGN

A. **Roadside, Street Name, and City Off-Street Signs:** Mounting of the sign to the pole for roadside, street name, and City off-street signs on City property shall be as shown on the Drawings and shall conform to the requirements of **Unistrut Telespar Sign Support System or equal.**

B. Mounting of Street Name Signs on street light standards using Cantilever support brackets shall be installed in accordance with the manufacturer's recommendations. Cantilever bracket system shall be installed on both the top and bottom of each sign.

C. An R26E, "Tow-Away Zone" shall be installed below each R26F sign in designated fire lanes.

- END OF SECTION -

Mechanical Electrical / Plumbing Building

SECTION 15010

GENERAL REQUIREMENTS - MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements," and this Section govern the work of this Division.

1.02 DESCRIPTION

A. This Division requires the furnishing and installing of all items including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, coordination, supplies, equipment, transportation, storage, hoisting, utilities and all required permits and licenses.

B. Specifications: Refer to this Division for the primary technical specifications of mechanical, plumbing and fire protection work (Requirements given within this Section apply to the Work of all Sections of this Division). The actual performance of the Work stays within the Section in which it occurs; but subject to the requirement of this Section to the extent applicable.

C. Work Included: This Work includes the furnishing of all labor, materials, equipment, fixtures, apparatus, and appurtenances and commissioning required for complete installation of operating heating, ventilating, air-conditioning, plumbing and drainage and fire protection systems as specified, in place and ready for service.

1.03 WORK SPECIFIED ELSEWHERE

A. Concrete pads and bases: Division 3 CONCRETE.

B. Electrical (except as specified herein): Division 16 ELECTRICAL.

C. Painting of exposed mechanical components: Section 09900 PAINTING.

D. Access panels in public area ceilings: Division 9 FINISHES

E. Additional and other access panels: Furnished under this Section. Installation of access panels is in Division 9 FINISHES.

F. Structural steel (except as specified herein) Division 5 METALS.

G. Firestopping and firesafing at mechanical penetrations: Section 07840 FIRESTOPPING

H. Subsurface drainage up to and including pits: Division 2 SITE WORK.

1.04 QUALITY ASSURANCE

A. Manufacturers, materials, and methods described in the various sections of the Specifications, and indicated on the Drawings are intended to establish a standard of quality, utility requirements and space requirements. Products manufactured by other companies are acceptable, provided they meet the performance requirements, fit in the available space, not heavier than the specified, equal or higher in operating efficiency, quieter, etc. Also, the fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers standard product will meet the requirements of the project design, Specifications and time constraints. The Owner/Architect shall be the sole judge of quality and equivalence of equipment, materials and methods and his decision shall be final.

B. The project requires compliance with City of Livermore Green Ordinances and LEED credits, as such, the energy efficiency and compliance with all the requirements of mandatory prerequisite and optional credit items is of great importance to the project. Contractor shall become familiar of the LEED requirements and comply in meeting all the requirements of the respective trade work. Refer to LEED checklist, drawings and specifications for other requirements.

C. All work shall comply with the applicable State, County and City Codes, Rules, Regulations and Ordinances.

1.05 SITE VISIT AND FAMILIARIZATION

A. General: Become familiar with the Drawings and Specifications, examine the premises, and understand the conditions under which the Contract shall be performed, prior to submitting a bid.

B. Site: Be informed of the site conditions, verify locations of new and existing equipment and utilities, and determine exact requirements for connections.

C. Coordination: Submission of a bid for this project infers that the Contractor has visited the site and has become familiar with the Drawings and site conditions and has included in his proposal all work necessary to properly install the systems on the project.

D. Pre-Bid Conference: Refer to Division 1.

1.06 DRAWINGS AND SPECIFICATIONS

A. General: The Drawings are schematic in nature and indicate approximate locations of the heating, ventilating and air conditioning systems, plumbing equipment, fixtures and piping systems, fire sprinkler equipment, risers, mains and heads, except where specific locations are noted and dimensioned on the Drawings. All items are shown approximately to scale. The intent is to show how these items shall be integrated into the construction. Locate all items by on the job measurement and in accordance with the Contract Documents. Cooperate with other trades to ensure project completion as indicated. Provide materials and systems indicated in either Drawings or Specifications.

The drawings alone may not be used for quantity take-offs of any items. If an item is

specified or scheduled to apply for certain location or use, it must be used everywhere at such locations or uses, whether shown on the drawings or not. For example if specifications require contractor to provide concealed damper regulator for dampers in inaccessible ceilings, they shall be provided for all dampers located above inaccessible ceilings, whether shown on the drawings (partially or fully) or not.

B. Location: Prior to locating diffusers, grilles, other exposed air devices, plumbing fixtures, fire sprinklers and plumbing items, obtain the Architect's approval as to exact location. Locations shall not be determined by scaling Drawings. Contractor shall be responsible for costs of redoing work of other trades necessitated by failure to comply with this requirement.

C. Specifications: The specifications are intended to supplement the drawings and it is not in the scope of the specifications to mention any part of the work which the Drawings fully explain. Conversely, any part of the work which the specifications fully explain, may not be mentioned on the Drawings.

D. Disagreement: Disagreement between the Drawings or Specifications or within the Drawings or Specifications shall be bid using the better quality or greater quantity of material or installation, and a request for clarification shall be made to the Architect. Do not proceed with the work without the Architect's decision on the request.

1.07 DISCREPANCIES

A. Clarification: Clarification shall be obtained before submitting a proposal for the Work under this Division referring to discrepancies or omissions from the Contract Documents or questions as to the intent thereof.

B. Detailed Instructions: Should it appear that the work hereby intended to be done or any of the materials relative thereto, is not sufficiently detailed or explained in the Drawings or Specifications, then the Contractor shall apply to the Architect for such further Drawings or explanations as may be necessary, allowing a reasonable time for the Architect to respond. The Contractor shall conform to this additional information as a part of the Contract without additional cost to the Owner or Architect.

C. Interpretations: Should any doubt or questions arise respecting the true meaning of Drawings or Specifications, reference shall be made to the Architect, whose written decision shall be final and conclusive.

D. Contractor Agreement: Consideration will not be granted for misunderstanding of the amount of work to be performed. Submission of a bid conveys full Contractor agreement of the items and conditions specified, shown, scheduled, or required by the nature of the project.

1.08 UTILITIES

A. General: Utility information shown on the Drawings have been shown based upon data obtained from the site survey and the agencies having jurisdiction and are accurate to the best of the knowledge of the Architect.

B. Coordination: The Contractor shall be responsible for field verification of the actual locations of site and/or building utilities and shall make modifications necessary for connection to or construction around those utilities at no additional cost to the Owner or

Architect.

1.09 CODES AND STANDARDS

A. Provide Work in strict accordance with Federal, State and City, codes, rules and regulations, as well as those of other regulatory agencies having jurisdiction. Do not construe Specifications or Drawings as permitting anything contrary to above requirements.

B. When Specifications or Drawings have more stringent requirements than the above mentioned laws, etc., Specifications and Drawings have precedence.

C. In case Specifications or Drawings do not comply with above mentioned laws, etc., the latter have precedence.

D. Provide Work in accordance with appropriate codes and standards.

1.10 LICENSES, PERMITS AND FEES

A. Procure and pay for licenses and permits and pay fees, deposits, and other charges required in order to provide Work of this Division.

1.11 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representatives of Architect.

B. Advise Architect that Work is ready for review at following times:

1. Prior to backfilling buried Work.

2. Prior to concealment of Work in walls and above ceilings.

3. When requirements of Contract have been completed.

C. Neither backfill nor conceal Work without Architect's consent.

D. Maintain on job a set of Specifications and Drawings for use by Architect's representative.

1.12 SCHEDULE OF WORK

A. Arrange Work to conform to schedule of construction established or required to comply with Contract Documents. In scheduling, anticipate means of installing0 equipment through available openings in structure.

1.13 SUBMITTALS

A. General: Submittals required for this project shall include, but not be limited to:

1. Coordination Drawings

2. Shop drawings and Product Brochures.

3. Samples and Mock-ups.

4. Certifications and Test Reports.

5. Operating and Maintenance Manuals.

6. Warranties (Guarantees).

7. Seismic Restraint Calculations.

B. Coordination Drawings:

1. The Contractor shall prepare and submit to the Architect for approval coordination drawings (Plans and Sections) of all areas of the Project and as outlined hereinafter.

2. Coordination drawings shall be prepared in sufficient time to allow for review and response by the Architect and correction by the Contractor so as not to delay the work.

3. Relocations required due to Work installed or modified prior to approval of coordination drawings shall be made without additional expense to the Owner.

4. The coordination drawings shall use a common architectural layout as a background. The drawings shall be prepared at the same scales to permit overlaying on light tables.

   a. Ductwork, Mechanical Piping, Mechanical Equipment, Plumbing and Automatic Temperature Control.

   b. Automatic Fire Sprinklers.

5. The original coordination drawings shall be prepared on 3 mil mylar at 1/4 in. scale on sheets of same size as the Contract Drawings.

6. The sizes and bottom elevations shall be shown for all rectangular ductwork; the sizes and centerline elevations shall be shown for all round ductwork and piping. Also indicate acoustical lining in ductwork. All major components, such as dampers, valves, and cleanouts shall be dimensioned from column centerlines. All access panel locations shall be indicated.

7. Deviations from the Contract shall be encircled, approval requested and the reasons for the deviation stated.

8. The coordination drawings of all trades shall be included in each submission. One complete floor of a building shall be included in each submission.

9. Double lines shall be shown for all ductwork and pipes 6 inches and above. Single lines shall be shown for lines below the sizes noted above.

10. Coordination drawings shall be printed and distributed in the same manner as required for Mechanical shop drawings.

11. All coordination drawings submitted for approval shall bear the signed approval stamp of each of the trades and/or subcontractors affected and of the Contractor, stating they have been reviewed and approved for coordination. All coordination drawings shall be keyed and cross referenced to the Contract Drawings.

12. Sepia copies shall be used for coordination between the trades and shall be submitted for approval.

13. The mylar originals of the coordination drawings shall be kept up to date with revisions which reflect the record conditions. The mylar originals of the coordination drawings shall be submitted to the Architect at the completion of all work for approval, corrected by the Contractor if so required, and returned to the architect prior to final payment to the Contractor.

14. The Contract Drawings shall not be considered as fabrication or installation drawings. They do not indicate every item required to complete the Work.

15. The Contractor shall show all offsets, fittings and similar items necessary in order to accomplish the requirements of coordination without additional expense to the Owner.

16. If Shop Drawings show variations from Contract requirements because of standard shop practice, or any other reasons, make specific mention of variations in transmittal letter to Architect, as well as encircle variation of Shop Drawings to identify and call them to the Architect's attention.

17. All dimensions shall be verified in the field.

18. Structural Beam Penetration Coordination: Beam penetrations shown on Mechanical and Structural Plans shall be verified by Contractor through shop drawing and details. Any new beam penetration that is required during shop drawing coordination shall be approved by the Architect and Structural Engineer.

C. Shop Drawings and Product Data:

1. Refer to individual Mechanical Section for submittals required.

2. If the equipment submitted under Division 15 requires changes in material or labor from that required in the Contract Documents, such changes shall be submitted as shop drawings.

3. Any changes in piping, wiring, controls, or installation procedures required by the equipment manufacturer shall be made at no additional cost to the Owner.

4. Submit a complete list of material and equipment proposed for the job, including manufacturer's names, even if they are as specified or shown on Drawings.

5. Reference listings to Specification's article to which each is applicable.

6. Include complete catalog information such as construction, ratings, and performance

curves as applicable.

7. For any material specified to meet UL, FM or other trade standards, furnish manufacturer's or vendor's certification that material furnished for work does, in fact, equal or exceed Specifications.

8. Add and sign the following paragraph on all equipment and materials submitted for review. Failure to add the following statement will result in delay of review of submittal:

   a. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the Project; is in compliance with the Contract Drawings and Specifications; can be installed in the allocated spaces."

D. Deviations from Contract Documents:

1. Submittals which are intended to be reviewed as a substitution, variations, or departure from Contract Documents, must be submitted to the Architect no later than ten (10) calendar days before date set for opening bids.

2. Unless Contractor has notified Architect of variations, deviations, or omissions and received his written acceptance, Contractor will be required at his sole expense to repair, replace, furnish whatever materials are required and perform work necessary to rectify such deviations and variations as directed by Architect at time such variations, deviations or omissions are discovered, even though this does not occur until after Shop Drawings have been reviewed and Work in question has been completed. Replacement and repair shall be mandatory in such instances and shall be performed at no cost to Owner.

3. Contractor shall be responsible for equipment ordered and/or installed prior to receipt of Shop Drawings returned from the Architect bearing the stamp of "Review". Corrections or modifications to equipment as noted on Shop Drawings shall be performed or equipment removed from the job site at request of Architect without additional compensation.

4. Submittals will be checked for general compliance with Drawings and Specifications only. The Contractor must be responsible for deviations from the Drawings or Specifications and for errors or omissions of any sort in submittals.

E. Required Shop Drawings:

1. HVAC: Submit Drawings, minimum scale 1/4 inches = 1'-0 inches unless otherwise noted.

   a. Floor Plans (Piping and ductwork)

   b. Roof Plans

2. Plumbing: Submit Drawings, minimum scale 1/8 inches = 1'-0 inches unless otherwise noted.

a. Foundation Plans

b. Floor Plans

c. Roof Plans

d. Toilet room Plans (minimum 1/4 inches = 1'-0 inches scale)

F. Samples: Submit two samples, where indicated on Drawings or Specifications or upon request, of mechanical/plumbing/fire protection devices and materials for review by the Owner/Architect. Samples will be returned upon written request of the Contractor.

1.14 OPERATING AND MAINTENANCE MANUALS

A. Submit two copies of Operating and Maintenance Manuals to the Architect for approval prior to the beginning of operator training. Provide four approved Operating and Maintenance Manuals for use in operator training. Manuals shall be bound in rigid cover, 3-ring binders with spine and cover labels and shall provide operating and maintenance information for every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference. Bulletins containing information about equipment which is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 15 shall be clearly and legibly set forth in memoranda which shall, likewise, be bound with bulletins. As a minimum, the following information shall be provided as applicable:

1. Complete description of each system, item of equipment, and apparatus provided under this Division, including ratings, capacities, performances, data and curves, characteristics identifying name and number, locations, wiring diagrams, and sources for all parts.

2. Fully detailed parts lists, including all numbered parts and recommended spare parts, of each item of equipment and apparatus provided under this Division.

3. Manufacturer's printed instructions describing operation, service, maintenance, and repair of each item of equipment and apparatus.

4. Typewritten record of tests made of materials, equipment, and systems included under this Division. Such records shall state the dates the tests were conducted, name(s) of person(s) making and witnessing the tests, and citing any unusual conditions relevant to the tests.

5. Identifying names, name tags designations and locations for all equipment.

6. Valve tag lists with valve number, type, color coding, location and function.

7. Equipment and motor nameplate data.

8. Copies of all approved Shop Drawing submittals and testing and balancing reports.

9. Fabrication drawings.

10. Equipment and device bulletins and cutsheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable.

11. Maintenance instructions clearly highlighted to show all required periodic maintenance and lubrication.

12. Wiring diagrams.

13. Operating instructions clearly highlighted to show proper operating procedures for all equipment.

14. Exploded parts views and parts lists for all equipment and devices.

15. Color coding charts for all painted equipment and conduit.

16. Location and listing of all spare parts and special keys and tools furnished to the Owner.

B. Tools: Provide and deliver to the Owner's authorized representative any special tools required for maintenance of systems, equipment, and apparatus installed under this Division prior to requesting final acceptance of the installation.

1.15 PROJECT RECORD DOCUMENTS

A. Site Prints: Maintain a set of clearly marked black line prints of the Contract Drawings at the job site which shall be used for recording the work details, final size, location, interrelation, and similar items of all work under this Division. This set of Drawings shall be corrected daily as the Work progresses and shall clearly indicate all changes to suit field conditions, changes made by "Field Order" or "Change Order", accurate dimensions of all buried or concealed work, precise locations of all concealed work, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall be to at least two permanent structure points.

B. Upon completion of the work, the Contractor shall transfer all marks from the site prints to a set of sepia mylar reproducible record "As-Built" Drawings using red pencil. The reproducible record "As Built" Drawings shall have the Engineer's name and seal removed or blacked out and shall be clearly marked and signed on each sheet.

1.16 MATERIALS AND WORKMANSHIP

A. General: Materials and equipment shall be new, of best grade and quality, and standard products of reputable manufacturers regularly engaged in the production of such materials and equipment.

B. Workmanship: Work shall be executed and materials installed in accordance with the best practice of the trades in a thorough, substantial, workmanlike manner by competent

workmen, presenting a neat appearance when completed.

C. Manufacturer's Recommendations: With exceptions as specified or indicated on the Drawings or in the Specifications, apply, install, connect, erect, use, clean, and condition manufactured articles, materials, and equipment per manufacturer's current printed recommendations. Copies of such printed recommendations shall be kept at the job site and made available as required.

1.17 SPACE REQUIREMENTS

A. General: Determine in advance of purchase that the equipment and materials proposed for installation will fit into the confines indicated, leaving adequate clearances for traffic, adjustments, repair, or replacement.

B. Clearance: Allow adequate space for clearance in accordance with requirements of the Code and local inspection department.

C. Scheduled Equipment: The design shown on the Drawings is based on the equipment scheduled.

D. Responsibility: Since space requirements and equipment arrangement vary for each manufacturer, the responsibility for initial access and proper fit rests with the Contractor.

E. Review: Final arrangements of equipment to be installed shall be subject to the Architect's review.

1.18 SAFETY REGULATIONS

A. All mechanical work shall be performed in compliance with all applicable and governing safety regulations. All safety lights, guards, signs, and other safety materials and provisions required for the performance of the mechanical work shall be provided by and operated by the Contractor.

1.19 DELIVERY, STORAGE AND HANDLING OF MATERIALS

A. General: Protect all materials and equipment to be installed under this Division from physical and weather damage.

B. Scope: Work under this Division shall include, but not be limited to:

1. Shipping from point of manufacture to job site.

2. Unloading, moving, and storage on site with proper protection required.

3. Hoisting and scaffolding of materials and equipment included in this Division.

4. Ensuring safety of employees, materials, and equipment using such hoisting equipment and scaffolding.

C. Coordination: All large pieces of apparatus which are to be installed in the building and which are too large to permit access through doorways, stairways, or shafts shall be brought to the job by the Contractor and shall be placed in the spaces before enclosing

partitions and structure are completed. All apparatus shall be cribbed up from the floor by Contractor and shall be covered with tarpaulins or other protective covering where required for protection.

1.20 NOISE AND VIBRATION

A. General: Warrant the heating, ventilating, air conditioning systems, and their component parts to operate without objectionable noise or vibration. Noise from systems or equipment which results in noise within occupied spaces above the recommended NC or RC curves (refer to ASHRAE Standard) shall be considered objectionable. Vibration shall not be apparent to the senses in occupied areas of the building. Objectionable noise, vibration, or transmission thereof to the building shall be corrected.

1.21 CONTRACTOR WARRANTIES AND GUARANTEES

A. General: Contractor shall guarantee all material and equipment installed by him against defective material and faulty workmanship for a period of 12 months after final acceptance of the work by the Owner and he shall repair or replace any materials or equipment revealing such defects within that time, promptly on due notice given him by the Owner and at Contractor's sole cost and expense. Due to the 24 hour operation of the building, the Owner may be forced to immediately do the repair work himself during the warranty period. The Contractor shall reimburse the Owner for such costs.

B. Equipment: All equipment bearing a manufacturer's guarantee, such as motors, AC units, water heaters, compressors, heat exchangers, water heaters, fans, controls, and similar items, may have an extended guarantee to the Owner by the manufacturer. Any such equipment that proves defective in materials or workmanship within the guarantee period is to be replaced by the Contractor in accordance with the manufacturer's guarantee.

C. Start-up: The Contractor shall provide instructions and equipment starting help on new equipment for one complete year after date of final acceptance of the work by the Owner, at Contractor's sole cost and expense.

1.22 OWNER INSTRUCTION

A. General: This Contractor and appropriate factory-trained representatives shall instruct the Owner's representative in the proper operation and maintenance of all systems and equipment and shall explain all warranties.

B. Outline: Prior to instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be included in this instruction, and submit the outline for review by the Architect.

C. Certification: At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the approved outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

D. Other Requirements: Refer to other Division 15 Sections for additional operator training requirements.

1.23 DEFINITIONS

A. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, or in enclosures.

B. "Connect": Complete hook-up of items with required services.

C. "Control or Actuating Devices": Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

D. "Drop": A vertical pipe or duct that does not penetrate a floor.

E. "Exposed": Not installed underground or "concealed" as defined above.

F. "Finished Space": A room or space that is not unfinished as described below. Any space ordinarily visible to the visiting public and staff (excluding maintenance personnel), including exterior spaces.

G. "Furnish" or "Supply": To purchase, procure, acquire and deliver complete with related accessories.

H. "Header": A pipe or duct of constant size that serves a battery of closely spaced inlet or outlet connections.

I. "Indicated", "Shown" or "Noted": As indicated, shown or noted on Specifications or Drawings.

J. "Individual Mechanical Section": Any of the Sections of the Specifications under Division 15.

K. "Install": To erect, mount and connect complete with related accessories.

L. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

M. "Other Division": The portions of the Specifications that does not include the Mechanical Division.

N. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

O. "Provide": To supply, install and connect up complete and ready for safe and regular operation of particular Work referred to.

P. "Public Space": A finished space (including toilets, lounges, restaurants) that is open to the general public using the Airport. Excludes Airport and Airline support staff areas, maintenance equipment/personnel areas.

Q. "Reviewed", "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect.

R. "Riser": A vertical pipe or duct having a vertical length greater than one story height.

S. "This Division": The Mechanical Division (Division 15) of the Specifications; a portion of the Specifications that includes all the Sections of the Specifications.

T. "Unfinished Space": A room or space that is ordinarily accessible only to building maintenance personnel. A room that in the Architect's finish schedule has exposed and unpainted construction for walls, floor and ceiling. Room specifically mentioned as "Unfinished".

U. "Upfeed Connection": A vertical pipe or duct that penetrates a floor, but has a vertical length of less than one story height.

V. "Wiring": Raceway, fittings, wire, boxes and related items.

W. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Materials and equipment shall be new, shall be current models of manufacturers, and shall bear complete identification by manufacturer.

B. All items of similar nature shall be by the same manufacturer. Trim for major items shall be by the same manufacturer as the item.

C. Materials and equipment shall be guaranteed by manufacturer to equal or exceed specified performance requirements.

D. Materials and equipment shall be those of major and reputable manufacturers with ability to render competent and thorough technical services through local organizations, and to expeditiously provide spare parts.

E. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from site.

F. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Provide optional or additional accessories as specified.

G. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance of Architect.

H. Equipment, material damaged during transportation, installation, and operation is considered as totally damaged. Replace with new. Variance from this permitted only with written acceptance.

I. Provide an authorized representative to constantly supervise Work of this Division, check all materials prior to installation for conformance with Specifications and Drawings.

PART 3 - EXECUTION

3.01 COORDINATION OF MECHANICAL WORK

A. General: Refer to Division 1 for general coordination requirements applicable to the

entire work. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and its interface with other work including utilities and electrical work and that such establishment is the exclusive responsibility of the Contractor. The Drawings show diagrammatically the sizes and locations of the various ductwork and piping systems and equipment items and the sizes of the major interconnecting ducts and pipes, without showing exact details as to elevations, offsets, control lines, and installation details.

1. Arrange mechanical work in a neat, well organized manner with services running parallel with primary lines of the building construction.

2. The Contractor shall carefully lay out his work at the site to conform to the architectural and structural conditions, to avoid obstructions and to provide proper grading of lines. Exact locations of outlets, apparatus and connections thereto shall be determined by reference to detail Drawings, equipment Drawings, roughing-in Drawings, etc. by measurements at the building and in cooperation with other Contractors and in all cases shall be subject to the approval of the Architect. Relocations necessitated by the conditions at the site or directed by the Architect shall be made without any additional cost to the Owner or Architect.

3. All ducts and pipes except those in the various equipment rooms, in unfinished spaces or where specifically designated herein or on the Drawings shall be run concealed in furrings, plenums and chases. Wherever conditions exist which would cause any of these items to be exposed in finished spaces, the Contractor shall immediately call the situation to the attention of the Architect and shall stop work in those areas until the Owner's Representative directs the resumption of the work. Submit for approval a Shop Drawing for any change in piping, equipment placement, ductwork, etc.

4. Equipment has been chosen to fit within the available space with all required Code and maintenance clearances and shall be installed as shown. Every effort has been made to also accommodate equipment of other approved manufacturers, however since equipment and access space requirements vary, the final responsibility for installation access and proper fit of substituted equipment rests with the Contractor.

5. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade or location for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:

    a. Building lines.

    b. Structural members.

    c. Soil and drain piping.

    d. Sprinkler piping. (Mains and branches larger than 1-1/2 inches).

    e. Vent piping.

f. Supply ductwork.

g. Exhaust ductwork.

h. Heating hot water piping.

i. Domestic water piping.

j. Electrical conduit.

6. Locate operating and control equipment properly to provide easy access. Arrange entire mechanical work with adequate access for operation and maintenance.

7. Advise other trades of openings required in their work for the subsequent move in of large units of mechanical work.

8. Coordinate all items which will affect the installation of the work of this Division. This coordination shall include, but not be limited to, voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

9. When submitting Shop Drawings, Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

B. Coordination Drawings: Prepare Coordination Drawings and Shop Drawings showing the actual physical dimensions (at accurate scale) required for the installation of mechanical system and equipment fitted within the allotted spaces. Prepare and submit coordination Drawings prior to purchase-fabrication-installation of any of the elements involved in the coordination.

3.02 INSTALLATION OF MATERIAL, EQUIPMENT AND APPARATUS

A. Installation of material, equipment and apparatus shall be in an orderly and neat manner, with like elements and appurtenances in similar location, position and elevation. The installation shall be adjusted for lighting fixtures, doors, windows, and other architectural elements to avoid interferences.

B. Operation, maintenance and access shall be arranged for in all installations in accordance with good practice.

C. Furnish access panels to service valves, cleanouts, shut-offs, dampers, sensors, controllers, equipment, and automatic devices at inaccessible locations and here indicated; sizes as required to permit easy servicing and removal of the item.

D. Manufacturer's Directions:

1. Follow in all cases where manufacturers of articles used provide directions covering points not specified or shown.

E. Equipment which is required to be field assembled shall be assembled under the direct supervision of the manufacturer's agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

F. Equipment:

1. Accurately set and level with supports neatly placed and properly fastened. Properly fasten equipment in place with bolts to prevent movement in earthquake. No allowance of any kind will be made for negligence on part of Contractor to foresee means of bringing in, installing equipment into position inside building.

G. Piping and/or Ductwork Systems:

1. Complete, integrated arrangement with like elements to make Work neat appearing, finished.

2. Run concealed, except as shown otherwise; where exposed, parallel with walls or structural elements; vertical runs plumb; horizontal runs levels, parallel with structure or uniformly pitched as appropriate.

3. Install with adequate passageways free from obstructions, as high as practicable to maintain adequate head room, as shown or as required. Notify Architect before installation whenever head room of less than 7 feet 6 inches will result. Coordinate with Work of other Divisions to achieve proper head room as specified in this Division.

4. Clearance: Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.

5. Flash and counterflash all pipes and ducts through roof.

6. Penetrations:

a. Insulated piping or ductwork through sleeves shall have uninterrupted insulation inside sleeves or openings. Pack space between piping or ductwork and sleeve or opening with non-combustible material.

b. Make penetrations through floors watertight with mastic even though concealed within wall or furred space. Provide suitable frame below slab to prevent packing from falling out. Caulk space between pipe or duct and concrete to full concrete thickness with rope, fiberglass, and mastic.

c. Make penetrations through any dampproofed-waterproofed surfaces dampproof-waterproof by appropriate means to maintain integrity of system penetrated. Includes penetrations caused by hangers suspended off such surfaces.

7. Cleaning and Closing: Inspect all piping, ductwork and equipment before placing; clean interior before closing. Close all piping and ductwork at end of each day's Work.

8. All motors and bearings shall be covered with watertight and dustproof covers during

construction period. All motors and belts shall be accessible for service.

9. Lubrication: Provide all lubrication for the operation of all equipment until acceptance.

10. Fixtures and Equipment Provided By Others (Not under this division): Where the Drawings indicate fixtures and equipment which are to be provided and installed by others, and which require connections to the Mechanical systems, provide and install all rough-in of piping or ducts. All necessary traps, stops, and supplies, and make final connections to the fixtures and equipment. Rough-in locations shall be determined from the equipment itself or from the equipment manufacturer's shop Drawings.

11. Valves shall be provided on all piping wherever shown or specified using adapters where required. All removable or replaceable equipment shall be valved. Valves shall have a securely fastened stamped brass metal plate, each bearing a different number identified in the maintenance manual.

12. All cooling, heating and reheat coils shall have hinged access doors in duct for inspection of coils on upstream and downstream side of coils and shall not be less than 12 by 12 inches. Access doors can be omitted at Air Terminal units' reheat coils.

3.03 PREVENTION OF RUST

A. Surfaces of ferrous metal exposed to weather or corrosive atmosphere shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test the specimen shall show no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where steel is specified to be hot-dip galvanized, mill galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint. Piping installed in raceways, shafts, furred ceilings and similar protected spaces shall not be coated unless specifically indicated on the Specifications or Drawings.

3.04 PROTECTION FROM MOVING PARTS

A. All belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts shall be fully enclosed with removable supports and properly guarded in compliance with the State of California Safety Codes. Provisions for removal of guards shall be made including provisions for RPM check. Guards shall be provided around all moving machinery parts such as pump couplings. Warning signs, as required by state regulations shall be posted near automatically started equipment.

3.05 SPARE PARTS DATA

A. As soon as practicable after approval of materials and equipment and not later than four (4) months prior to the date of beneficial occupancy, furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies, with current unit prices and sources of supply.

installations and maintenance requirements. The systems covered shall be HVAC, Plumbing and Fire Sprinklers.

E. The air and water balancing Subcontractor's representative shall conduct a training session with the Owner's engineers to review the procedure and methods used and results obtained in the balancing process.

3.12 START-UP SERVICE

A. Equipment Check-Out:

1. Prior to start-up, check proper equipment rotation, wiring, auxiliary connections, lubrication, venting, controls, and properly set relief and safety valves.

B. System Start-Up:

1. Start and operate systems. Provide services of factory-trained technicians for start-up of major equipment and systems, including fans, AHU's, AC units, pumps, heat exchangers, water heaters, etc.

3.13 SPECIAL TOOLS

A. Furnish to Owner one (1) set of any special tools required to operate, adjust, dismantle, or repair any equipment of this Section. "Special tools" mean those not normally found in possession of mechanics or maintenance personnel. Also location of supplier where extra sets can be purchased.

3.14 RECORD DRAWINGS

A. Record of Job Progress:

1. Keep an accurate record of as-built locations and of Work. Keep record up-to-date on blueline prints as job progresses and available for inspection at all times. Progress payment will not be approved if Drawings are not current.

B. In addition to any other requirements, include on as-built Drawings the following:

1. Main shut-off valves plainly marked and identified.

2. Position of buried or concealed mains accurately dimensioned, both horizontally and vertically.

3. Changes in location of piping, duct, or equipment.

4. Ceiling access panel locations.

3.15 SAFETY

A. In accordance with generally-accepted construction practices, the Contractor will be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the Work. the requirement will apply continuously and not be limited to normal working hours.

B. The duty of the Architect to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures, in or near the construction site.

3.16 FINAL REVIEW

A. General: Upon completion of the Work, perform a final inspection and test of the entire system.

1. The system shall be operating properly with all water and air volumes balanced and all temperature controls adjusted.
2. After the final inspection and test, any changes or corrections noted as necessary for the Work to comply with these Specifications or the Drawings shall be accomplished without delay in order to secure final acceptance of the Work.

3. The date for the final test shall be sufficiently in advance of the Contract completion date to permit execution, before expiration of the Contract, of any adjustments or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment. Any such modifications shall be completed within the time allotted for completion of the Contract. Retests shall be conducted as directed and shall be of such time duration as necessary to ensure proper functioning of adjusted and altered items. Retests shall not relieve the Contractor of completion date responsibility.

4. Certificates, including certificates of occupancy from local authorities and documents required herein, shall be completely in order and presented to the Architect at least one week prior to the review.

B. Qualified Person: Individuals knowledgeable of the systems and persons approved by the Architect, shall be present at this final inspection to demonstrate the system and prove the performance of the equipment.

C. Comply with all the LEED requirements including providing documentation necessary to show the compliance with the selected LEED checklist items, complying with the construction waste recycling requirements, satisfying indoor environmental quality requirements during construction and prior to occupancy, certifying the installation of the equipment and systems through testing and commissioning, etc.

END OF SECTION

SECTION 15200

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The intent of these specifications and supplemental drawings is to define the HVAC criteria and scope of work for the HVAC trade contractor to provide HVAC system and associated control system for a complete and fully functioning HVAC system for the facility.

The Contractor shall include in this price all items indicated and/or specified and of work reasonably inferred by these specifications and required for compliance with applicable codes to provide such fully functioning facility with all systems complete. If the Contractor is in doubt as to the intent of any portion of these specifications and drawings or suspects necessary information is omitted, then the Contractor shall notify the Owner in writing in sufficient time for the Owner's clarifications or corrections by addendum.

B. The Contractor shall review drawings and specifications of all disciplines (i.e., Architectural, Structural, Mechanical, Electrical, Civil & Landscape etc.), and include all related mechanical work unless specifically excluded.

C. The contractor shall coordinate the work of this trade with the work of all other trades during design phase as well as during construction. Contractor shall include in the scope providing all necessary utilities, services, temporary connections, controls, plumbing & electrical provisions as necessary for a complete system. The Contractor shall include all leakage testing, balancing of air & water systems, functional and performance testing and documentation necessary for T-24 and LEED compliance.

D. Related Sections: The completion of the work described in this Section may require work in or coordination with other Sections of these specifications. The Contractor shall be responsible for identifying and including all related work in other Divisions and Division-15 specification Sections and/or drawings necessary for a complete installation of the work described in this Section.

1.02 SCOPE OF WORK

A. The scope shall include the design of the HVAC work, materials, equipment, fabrication, installation and tests in conformity with applicable codes, professionally recognized standards and authorities having jurisdiction as follows:

1. Seismic anchorage calculations for all the equipment including but not limited to rooftop AC units and exhaust fans, ductwork and piping.

2. Submittal of HVAC system submittals for equipments and shop drawings for all City/County/State approvals as required for permits and inspections

including Title 24 and LEED requirements.

3. Submittal of HVAC drawings to other entities including but not limited to the local utilities companies for service applications, LEED-NC v2.2 compliance requirements, savings-by-design, etc. as identified by the architect.

4. Provide Testing and Fundamental Commissioning for all equipments and systems identified in Section 01810 – Commissioning, including the preparation and submitting of necessary Reports.

5. The HVAC scope of work shall include but not be limited to the following:

   a. Provide all equipment, shipping, storage, handling, labor, factory start-up and commissioning for all the HVAC systems serving the building.
   b. Provide control system for the HVAC system including all the low-voltage (24-volt) power and control wiring, network communication wiring, conduits and cables, etc.
   c. Provide all exterior architectural louvers required and/or inferred in the various documents, all sheetmetal flashing and counterflashing. Coordinate with architect for size, quantity and locations. Provide acoustically lined plenums at the air intake and exhaust louvers through the side wall louvers.
   d. Provide all air inlets and outlets and air distribution for the project. Coordinate the location of the air inlets and outlets with architectural reflected ceiling plans and lighting plans.
   e. Provide programmable electronic room thermostats for each unit and mount them for ADA compliance. Provide carbon dioxide (CO2) room sensors for conference rooms and high density spaces mandated by T-24 and LEED to adjust the outside air and exhaust air dampers to maintain CO2 levels to within the acceptable range.
   f. Provide supports and seismic restraints for all equipments, ductwork, piping and conduits. Submit engineered seismic calculations for all equipments weighing in excess of 40 pounds.
   g. Provide make-up air and exhaust system for the toilet rooms, janitor rooms, electrical rooms, etc.
   h. Provide rooftop packaged gas-electric air-conditioning units (AC Units) to serve the respective areas. Each of the AC units shall be provided with low pressure drop MERV 14 filters, controls, air distribution including all the FSDs and balancing dampers, duct insulation and automatic shut down as required by CMC.
   i. Provide hot water flues and combustion air intake for the domestic water heaters, per the water heater manufacturer requirements. Terminate the heater vents per Code.
   j. Division-15 contractor shall furnish and install all required fire dampers (FD), smoke dampers (SD) and combination fire-smoke dampers (FSD) and associated smoke detectors. The FSDs and the smoke detectors shall be powered, controlled and status monitored by Division-16.

B. Related Work

1. Plumbing.
2. Electrical.
3. Fire Protection System.
4. Commissioning.
5. Project Sustainability Requirements

1.03 QUALITY ASSURANCE

A. Contractor's Qualifications: Regularly engaged in construction on projects of similar sizes using types of equipment, material and methods as specified herein - for minimum of 5 years. A letter from the contractor certifying these qualifications must be provided to the Owner before signing the construction contract.

1. By accepting to work, the Contractor agrees that he has understood the intent of the design/build and is reasonably sure that it can be accomplished by proceeding in accordance with these drawings and specifications.
2. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
3. Supply all equipment and accessories new and free from defects.
4. All items of the same given type and size shall be the products of the same manufacturer.
5. Satisfy seismic requirements of the State of California.
6. Comply with all applicable State, County and City Codes and Regulations including T-24 and City of Livermore Green Ordinance & LEED requirements.

1.04 SUBMITTALS

A. Prepare and submit the following Shop Drawing information to the owner/Architect in an organized manner for all equipment and materials used in the project:

1. Manufacturer's name, brand name and catalog reference of all equipment and materials supplied. Submit complete material and equipment list prior to submittal of Shop Drawings. Submit sound data, energy efficiency data, certified performance data, weight, size, etc. for each piece of equipment.
2. Detailed description of items supplied, including specifications, performance characteristics, materials, diagrams and schedules.
3. Seismic calculations stamped by a registered civil/structural engineer

D. Refer to Division-0 and Division-1 sections for other requirements for the submittal requirements for warranty and guaranty period, equipment start-up and commissioning, T-24 & LEED certification requirements, owner training, spare parts, etc.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be shipped in its original packages to prevent damaging or entrance of foreign matter. All handling and shipping shall be performed in accordance with manufacturer's recommendations. Provide protective covers during construction.

B. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the Architect.

C. All items shall be tagged with a weatherproof tag identifying equipment by name and purchase order number. Packing and shipping lists shall be included.

1.06 CRITERIA

A. Outside Design Conditions

1. Summer: 95°F Dry Bulb and 68°F Wet Bulb.

2. Winter: 22°F Dry Bulb.

B. Inside Design Conditions: (°F).

	Summer	Winter
	74	72

C. Related Documents

1. Refer to accompanying A-series drawings for building envelop data, space layout, ceiling height, number of people and activity in each space.
2. USGBC/LEED-NC v2.2 Checklist.
3. T-24 analysis, report and installation certification.
4. M, E & P series D-B Criteria drawings and specifications.

1.07 RECORD DRAWINGS

A. Maintain complete set of HVAC and Control Record Drawings (field drawings) indicated all work installed differently from original Contract Drawings

B. At end of project, transfer all changes via CAD (AutoCAD) and submit one set of plots electronic disk and field drawings to Owner.

PART 2 - PRODUCTS

2.01 PACKAGED ROOFTOP AC UNITS:

A. Manufacturer: Trane, Carrier, York or approved equal.

B. The Packaged rooftop AC units shall be gas-electric packaged unit complete with prefabricated roof curb, relief/exhaust fans, automatic control dampers for outside air and exhaust air, integrated economizer controls, variable capacity, Non-CFC and Non-HCFC refrigerant based and integral high-efficiency gas furnace. Single point power connection, insulated double wall, insulated access doors. UL listed and meet CAC Title 24 energy regulations.

C. Units shall be equipped with matching T-24 compliant electronic programmable room thermostats and carbon dioxide room sensors and associated sequence of controls to maintain the room temperature and CO2 levels at an optimum level.

D. The units shall be listed by UL and/or Electrical Laboratories (ETL) and bear the UL/ETL labels.

E. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and all wiring in EMT conduits. All outdoor wiring shall be in liquid-tight galvanized conduits and Nema-3R rate enclosures.

F. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

G. A full charge of R-410A for the units shall be provided.

H. The units shall be started-up and commissioned by the factory trained representatives.

I. The units shall be capable and ready for networking the controls and monitoring and programming from a central building controller by the maintenance engineer.

J. Fans: Statically and dynamically balanced.

2.04 Exhaust Fans: Greenheck or equal, spun aluminum construction, mushroom type, premium efficiency motor, backdraft damper, bird screen, mounted on prefabricated insulated roof curb, vibration isolators and seismic anchorage. Fans shall be direct drive with factory installed speed controllers for air balancing. Fans shall be UL listed and Capacity as scheduled.

2.05 Fire-smoke dampers: UL 555S & California State Fire Marshall Listed, Ruskin FSD-60 or approved equal combination fire-smoke dampers with electric actuators, end switches, fusible link and other features as required per the application requirement. For FSDs with wall registers, provide front access type FSDs with integral supply and exhaust registers in

the rated walls.

2.06 DUCTWORK:

A. General:

1. Construct with gauges, joints, bracing, reinforcing, and other construction details per CMC, ASHRAE, or SMACNA unless specified otherwise, and comply with the requirements of NFPA. Comply with most stringent.

2. Construct ductwork of low carbon galvanized sheet metal of lock forming quality (LFQ), and minimum 1.25 oz. per square foot galvanized, except where otherwise indicated. Sheet metal gauge and LFQ visibly marked thereon by manufacturer.

3. Diagonally or transversely crossbreak panels on metal rectangular ducts over 18" in either direction.

4. Duct dimensions indicated are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

5. Classifications: Classify and construct ducts per latest SMACNA classifications as follows:

   a. All Supply and Return Air Ducts and other Supply Air Ducts: +/-2" static pressure rating; 2,000 FPM maximum, seal Class B.

   b. All Supply ducts located outdoors shall be designed for +/- 2" static pressure rating; seal class A and internally insulated with 2" thick duct liner. The top of the ductwork cross-broken to prevent water ponding.

6. Provide all necessary transitions and additional fittings as required to clear obstructions, maintain clearances, and coordinate with other trades at no extra cost to the Owner.

7. Joint Sealing: Seal all transverse and longitudinal joints of all ductwork to comply with CCR Title 24. Seal duct joints using Hardcast PS-S tape or DT tape and HD-20 adhesive as recommended by manufacturer. At Contractor's option, United Hi-Vel sealer may be used for duct joint sealing.

8. Provide intake and exhaust hoods to prevent entry of rainwater through the AC unit opening.

9. The rooftop equipment curbs, equipment support pads, shaft closure caps and all support rails and piers shall be provided with stainless steel caps to prevent entry of rainwater through the respective support systems.

B. Round Duct Fittings: Fittings shall be manufactured by United Sheet Metal, or approved substitute, or may be manufactured by the Contractor is of equal quality and pressure loss.

1. Elbows shall be five piece with centerline radius equal to 1-1/2 times the diameter for medium pressure ducts. For low pressure ducts, centerline radius shall be minimum 1 times the diameter.

2. Fittings shall be smooth on the inside and shall be designed for minimum pressure drop and minimum noise generation.

3. Pleated and adjustable elbows, non-standard "jerry-rigged" fittings not allowed.

C. Rectangular Duct Fittings: Fittings shall be manufactured according to SMACNA standards.

1. The throat radius of all bends shall be 1-1/2 times the width of the duct wherever possible and, in no case, shall the throat radius be less than one width of the branch duct. Provide square elbows with double thickness turning vanes where space does not permit the above radius or where square elbows are shown.

2. The slope of transitions shall be approximately one to five and no abrupt changes or offsets of any kind in the duct system shall be permitted without prior approval.

D. Flexible Ducts:

1. Thermaflex, Genflex, or approved substitute, flexible sound absorbing ducts with scrim cloth inner liner and outer plastic liner, R-4 insulation, helical support wire. UL Class I air duct to comply with UL-181.

2. Low Pressure Duct: Thermaflex M-KE, or approved substitute. Use for final connections to all ceiling supply air outlets.

F. Exhaust ductwork: Same as for the supply and return air ducts.

2.07 DUCTWORK SPECIALTIES:

A. Flexible Duct Connections: Ventfabrics, or approved substitute. Ventglass if exposed to weather. Install to maintain not less than 2" metal to metal separation

B. Turning Vanes: Double thickness, airfoil-type.

C. Bird Screens: 14 gauge, 2" galvanized wire mesh, set in galvanized steel frame

D. Duct Access Doors: With hinges and latches, Ventlock, or approved substitute. Insulated as specified for ducts in which installed. Size as required for proper access.

E. Concealed Damper regulators: Ventlok model 677 or equal, with mitergears and rod attachments as required.

2.08 AIR OUTLETS:

A. Acceptable manufacturers are Titus, Krueger,Tuttle & Bailey, ETI, or approved substitute.

B. Outlets may be steel or aluminum. Provide aluminum in toilet rooms and janitor rooms and other wet areas.

C. Provide factory-baked white enamel unless otherwise indicated. Flat black interiors on perforated face outlets.

D. Provide gaskets at supply outlet flanges. Provide frames to match the ceiling type.

E. On grilles, diffusers, or registers utilizing a plenum box, provide box fabricated of 22 gauge, zinc coated steel with internal surfaces internally lined with minimum 1" thick duct liner as specified under INSULATION.

F. Provide all exterior louvers and grilles and exhaust outlets as required and when not provided under other divisions. Coordinate with architect for type, size, and style.

2.09 DAMPERS:

A. Balancing Dampers:

1. Construct balancing damper per SMACNA. Use single blade or multi-blade dampers per ASHRAE/SMACNA recommendations.

2. Provide hand locking quadrant with standoff bracket.

B. Automatic Control Dampers:

1. In Rectangular Duct: Ruskin, Model CD-35 opposed blade control damper with neoprene jamb and blade edge seals

2. Round Ducts: Ruskin, Model CDRS-25, control damper with neoprene seal

C. Fire Dampers: U.L. listed and California Fire Marshal approved.

1. Supply Air: Air Balance Inc., 119BLX, 100% free area.

2. Return Air: Air Balance Inc., 119BLX, 100% free area.

3. Ceiling: Air Balance Inc., assembly A-2 with FD-30 fire damper.

4. At wall outlet: Air Balance Inc., 119AF

D. Backdraft Dampers: Ruskin, Airodynamic counterbalance-type, Model CBD-4, or approved substitute.

E. Combination Fire/Smoke Dampers

1. California Fire Marshal approved, UL listed per UL 555 (1-1/2 hour fire damper) and UL 555S leakage Class I and 350 degrees F elevated

temperature rating.

2. Heavy 13 gauge equivalent frame construction.

3. Low pressure drop airfoil or single blade.

4. Firestat to close damper at 212 degrees F.

5. Damper electric actuator, power open - fail close type, heavy duty, low noise and non-stall type.

6. Ruskin FSD60 or approved substitute.

7. All FSD'S shall be installed with remote position indicator light plate affixed to the ceiling tile.

2.10 FANS:

A. Provide fans constructed and factory-tested in accordance with AMCA and ARI. Fan wheels statically and dynamically balanced.

B. Manufacturers: Greenheck, Cook, Twin City or approved substitute.

C. Bearing Life: AFMBA L-10 life of 40,000 hours minimum, 200,000 hour average.

2.11 EQUIPMENT SUPPORTS:

A. All rotating equipment and equipment capable of transmitting vibration into the space shall be mounted on vibration isolators and bases. The isolators and bases shall be properly sized by the isolator manufacturer, taking into account the piece of equipment, its center of gravity, anchor points, weight of bases, and the structure upon which it is setting, so that vibration transmitted to the structure is held to a level acceptable to the Owner.

B. Isolators shall be provided for equipment mounted aboveground and as required by acoustical consultant.

C. The isolators shall be fastened to the structure and to the equipment with properly sized and structurally engineered anchors and bolts. Structural calculations shall be provided by the isolator manufacturer or supplier.

D. The bases and isolators shall be as manufactured by Mason, Kinetics, or Amber-Booth. Other manufacturers not allowed.

E. Isolator springs shall be as follows:

1. Single coil cadmium-plated helical steel springs with minimum diameter 0.8 of operating height.

2. Reserve deflection (from operating to solid height) 50% of specified deflection.

3. Ratio of horizontal to vertical spring constants shall be within range of 0.90 to 1.10.

4. Provide corrosion resistant protection for all springs and their housings, for out-of-doors installations, and also for materials exposed to out-of-doors during construction. Hot-dipped galvanized or coated with neoprene or polyvinylchloride.

F. For rooftop pipes and conduit supports, provide premanufactured non-combustible sleeper supports, which are attached to the roof structure and flashed, as manufactured by B-Line or equal..

2.12 SEISMIC RESTRAINTS:

A. General: Provide seismic restraints per applicable code and standards. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift. Restraints shall not short circuit vibration isolated equipment under normal operation.

B. Requirements:

1. Criteria: Design restraints per SMACNA/PPIC "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", for equipment, ducts, and piping.

2. Seismic Force Criteria: 1 G

3. Contractor shall submit Seismic Restraint calculations that are signed by a structural engineer registered in the State of California. Calculation must confirm the adequacy of the restraints and their anchoring to the building structural elements.

2.13 INSULATION: Insulation for ductwork, piping and equipment shall be in conformance with the California Title-24 2008 Edition for Non-residential buildings requirements and per this Section.

A. Ductwork Insulation:

1. Wrap all unlined sheet metal supply and return ducts with minimum 1-1/2" thick duct wrap with reinforced foil facing, Fiberglas RFK 75 insulation as manufactured by Owens Corning Fiberglas Corporation, Manville, or Certain-Teed. Adhere to duct surfaces with Foster #81-99, or approved substitute, adhesive, applied in strips about 6" wide on approximately 12" centers. Lap all circumferential joints and longitudinal joints a minimum of 2". On circumferential joints, the 2" flange of the facing shall be secured using 9/16" flare door staples applied 6" on center and taped with a minimum of 3" wide foil reinforced craft tape. All pin penetrations or punctures in facing shall also be taped.

2. Provide acoustical lining in rectangular supply and return air ducts exposed to outdoors. Per SMACNA Duct Liner Application Standard and as follows:

lining shall be 2" thick, except where noted otherwise. 3# minimum density J-M Microcoustic, Fiberglas, or Certain-Teed with black coating and shall comply with UL-181. Cement the lining in place with 100% coverage of adhesive and coat all butt joint edges and joints with sealants. Cover all joints and exposed edges of duct liner with 6 oz. canvas cemented in place with Arabol. No bare fiberglas edges shall be left exposed to air stream. Adhesive and sealants shall be UL listed or classified Type I per Adhesive and Sealant Council Standard ASC-A-7001.

3. Provide Plenum lining in return exhaust and outside air plenums where indicated on the drawings. Lining shall be 2" thick 3.0 PCF density black coated rigid fiberglass board. Apply as indicated above for duct lining.

4. All externally insulated piping and fittings located on roof and exposed to weather shall be protected with aluminum jacketing (Childers or equal) to prevent the entry of moisture. The aluminum jacketing shall cover 100% of the insulation including the elbows and fittings.

B. Piping Insulation:

1. Insulate piping and equipment per Title-24 2005 Edition for Non-residential buildings, Section 123 "Requirements for Pipe Insulation", except for cold water, vents, overflow drain and relief piping as allowed by Exceptions" to Section 123. Insulation, jackets, facings, adhesives coatings and accessories fire hazard rated by Underwriters' Laboratories, Inc. The flame spread rating not-to-exceed 25, fuel contributed and smoke developed rating not-to-exceed 50. Insulation shall be labeled per Title-24 CEC-2005 Edition.

2. Piping insulation shall mean insulation of all components of the piping system including, but not limited to piping, fittings, flanges, equipment, tanks, valves, pump volutes and all exposed surfaces subject to temperatures above 100 deg F or below 60 deg F.

3. Insulation material: Molded fiberglass pipe covering, Owens Corning Fiberglas SSLII or equal. Minimum density 3.5 PCF, maximum thermal conductivity of 0.25 BTUH/sq. ft. °F./in. at 75°F.

4. Jacket: Factory applied, paintable, white kraft outer surface bonded to aluminum foil and reinforced with fiber glass yarn with self-sealing lap. Maximum vapor permeance of 0.02 perms and minimum beach puncture of 50 units. Seal end joints with sealing strip or tape to provide vapor tight installation.

5. Fittings and Valves: Premolded PVC fitting covers over precut insulation of same thickness as adjacent piping. In addition, on cold and chilled water pipes, apply vapor-barrier adhesive mastic on PVC cover seams and on circumferential edges wrap with vapor-barrier pressure-sensitive tape. The tape shall overlap 2" over the adjacent pipe insulation.

6. Expansion Joints: At all the expansion joints in insulated piping, provide factory made insulation covers specifically made for the purpose. The

covers shall be preshaped, shall cover entire joints including flanges and shall allow the anticipated movement of the joints without breaking the insulation or jacket. The covers shall also be removable to facilitate inspection of joints by maintenance personnel. Insulation for chilled water and cold piping shall allow for continuous vapor barrier across the joints.

8. System Codes and Insulation Types: Provide fiberglass insulation, unless indicated otherwise.

   a. CODE I - Domestic hot water, tempered water

   b. CODE II - Rainwater Leaders, Storm and overflow drains (where indicated)

   c. CODE III - Condensate drains, domestic cold water (where indicated)

   d. CODE IV - Lavatory drain traps and tail pieces, refrigerant pipes.

9. Piping Insulation Schedule:

	Pipe Sizes	
System Code	2" and Smaller	2-1/2" and Larger
I	1-1/2"	1-1/2"
II	1"	1"
III	1"	1"
IV	1/2"	--

   a. Where piping systems are scheduled, insulate all supply and return piping.

C. Equipment Insulation

   A. Rigid Board without Vapor Barrier Equipment Insulation:

      a. Insulation: Fiberglass board, Owens Corning Fiberglas Type 705 or equal. Minimum density 6 PCF, maximum thermal conductivity 0.25 BTUH/sq. ft. °F./in. at 75°F.

      b. Application: Impale insulation on weld pins on flat surfaces, or band in place on irregular surfaces with 16 gauge annealed steel wire on maximum 9" centers. Apply 1/4" coat of insulating and finishing cement filling all voids. Secure lightweight glass cloth with Foster 30-36 adhesive over cement.

   B. Calcium Silicate Equipment Insulation:

      a. Insulation: Preformed calcium silicate block insulation. Minimum density 12.5 PCF, maximum thermal conductivity 0.40 BTUH/sq. ft. °F./in. at 200°F.

b. Application: Securely band blocks, tightly butted, and joints evenly staggered with 16 gauge galvanized annealed steel wire on maximum 12" centers. Provide weld pins, clips, and angles for anchors. Stretch 2" hexagonal mesh wire on anchors. Apply 1/4" coat insulating and finishing cement. Apply heavy weight glass cloth with Foster 30-36 adhesive. Apply finish coat of adhesive.

C. Plastic Foam Equipment Insulation:

a. Insulation: Plastic foam with minimum density 5.0 PCF, maximum thermal conductivity 0.28 BTUH/sq. ft. °F./in. at 75°., and maximum flame spread rating of 25.

b. Application: Adhere insulation to clean, oil free surfaces with adhesive. Seal joints with adhesive.

c. Finishes: Apply flexible waterproof finish from manufacturer over all insulation outdoors.

D. Equipment Insulation Schedule:

Service	Temperature Range	Insulation Type	Insulation Thickness
Boilers, Water Heaters, Hot Water Storage Tanks, and other hot surfaces.	All	Rigid Board without Vapor Barrier	1-1/2"

D. condensate Drain Piping: Insulate indoor condensate drainage piping with 1" foam insulation Armstrong or approved equal. Protect outdoor insulation with aluminum jacketing.

2.14 TEMPERATURE CONTROL:

A. Contractor shall provide temperature control system to control and monitor, start-stop, adjust heating and cooling set points, for each of the packaged rooftop AC units and the associated exhaust fans.

B. The AC unit controllers shall be capable of being networked to a central controller for remotely scheduling the start-stop, monitoring alarms, changing the room set points, etc. without adding any additional control devises at the units. Acceptable manufacturers are Trane, Carrier, York or equal.

C. Provide complete control wiring between the room thermostat, CO2 sensors and outdoor AC units, for proper operation of the unit.

D. All work shall be coordinated with other trades and the building owner to minimize impact on the areas served by the system.

E. All power and control wiring shall be in EMT conduit per Division-16 specification requirements. All electrical power and control wiring connections on roof shall be in liquid tight conduits.

PART 3 - EXECUTION

3.01 GENERAL

A. Check Architectural drawings and drawings of other trades relating to work to verify spaces in which work will be installed. Maintain headroom and space condition to all points. Install ductwork tight to the underside of the structure and coordinate with other tradework to avoid conflicts. Where necessary reroute or reshape the ductwork of equal cross section to avoid conflicts. Any equipment, materials, piping, ductwork and air devices installed in conflict with the dropped ceiling and lights shall be relocated at the direction of the Architect at no additional cost to the Owner.

B. Set and layout work on premises. Base all measurements from approved bench marks and correct setting or work to agree with established lines and levels. Should discrepancy exist between actual measurements and those indicated, notify Architect in writing and do not proceed with work affected until written instructions are received from Architect.

C. Install equipment and ductwork rigid and secure, plumb and level, and in true alignment with related and adjoining work. No welding of HVAC materials for attachment or support is permitted.

D. Drawings and Arrangement: Install equipment and materials with all working parts readily accessible for inspection, repair and removal. The right is reserved to make reasonable changes in locations of equipment shown on drawings prior to roughing-in without involving additional expense to the Owner.

E. Prior to all work of this Section, carefully inspect the existing and installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

F. The installation of all ductwork, louvers, dampers, etc., shall be according to the SMACNA standards.

G. Ducts shall be hung with galvanized 1" x 18 gauge duct straps with spacing as recommended by SMACNA or as required by local codes, whichever is most stringent.

H. Provide sway bracing on all ductwork in accordance with the local codes and seismic requirements.

3.02 PIPING INSTALLATION

D. Thoroughly clean all pipe and maintain in such condition throughout construction. Temporarily cap off plug ends of unprotected pipe.

E. Install unions at connections to equipment, on service side of valves and elsewhere as required or shown to facilitate maintenance.

F. Install dielectric insulating connections between all dissimilar metals unless otherwise indicated.

G. Run all piping generally level, free of unnecessary traps and bends, and arrange to conform to the building requirements and to suit necessities of clearance for other work.

H. Arrange piping and hangers to allow for expansion, contraction, and structural settlement. Do not install piping in contact with the building structure.

I. Make changes in size or direction with manufactured fittings. The use of bushings, reducing flanges, or bending of a pipe is not allowed.

J. Install piping full size through shut-off valves, balancing valves, etc. Change pipe size within three pipe size diameters of the final connection to fixtures and equipment.

K. Unless specifically indicated otherwise, install piping concealed above ceilings, beneath the floors, or in walls. Route piping to linear beams, columns, obstructions and the work of other trades.

3.03 START-UP SERVICES:

A. Prior to start-up, ensure that the systems are ready, including the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting controls, all filters in place and properly set relief and safety valves.

B. Start and operate all systems. Provide the services of factory trained technicians for start-up of major equipment and all systems including but not limited to temperature controls, AC units, and fans.

C. Adjust all controls, fans, flow and pressure regulators, and any other adjustable equipment for optimum performance and to suit job conditions.

D. Personnel performing start-up services shall be fully qualified, experienced, and normally engaged in this type of work. If the Contractor does not have such personnel available from his own company, he shall hire, at his own expense, Subcontractors who are qualified.

E. The Contractor shall designate one field person who is overall responsible for start-up procedures which include testing and balancing. He shall directly supervise the start-up operations and be available for required coordination before, during, and after start-up. Coordinate with the commissioning agent and GC for commissioning

the equipment and systems.

F. A final and complete start-up, pre-functional test and functional test reports shall be submitted prior to final acceptance and payment. This report shall be signed by each person doing the start-up task and by the responsible field person. Report shall include, but not be limited to: date of test, instrument used, date of last calibration, temperatures, humidities, set points, rpm, voltage, amperage, pressures, stability, vibration, etc.

3.04 CLEANING

D. Brush and clean work prior to concealing, painting and acceptance. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance. Remove debris from inside and outside of material, equipment and structure.

3.05 TESTING, ADJUSTING AND BALANCING:

D. Personnel performing testing, adjusting and balancing shall be fully qualified, experienced, and normally engaged in this type of work. The Contractor shall have membership in the AABC, or certified by the NEBB and shall have no less than 5 years experience of projects in similar scope and complexity.

E. Provide all labor, equipment, and materials required to perform tests and balancing. Instruments for testing and balancing shall have been calibrated within a period of six months and verified for accuracy prior to start of work.

F. Protect valves and equipment from damage during tests. Include connection to previously tested sections, if the systems are tested in sections.

G. Prior to the final observation of construction or commencement of the balancing procedure, whichever occurs first, operate all systems for at least 72 consecutive hours in automatic mode, or longer if required, to prove satisfactory automatic operation. If system shutdown is experienced for any reason, repeat the test until 72 consecutive hours are achieved. Operate equipment as recommended by the equipment manufacturer's and in such a manner as to avoid damage to the work of other trades.

H. The air systems shall be adjusted and tested as specified below by the Contractor before full balancing.

1. Complete all Punch List items.

2. Install all dampers and other balancing devices as called for in the construction documents, and verify that same are properly installed, indexed, and in good working order.

3. Place all systems in automatic operation.

4. Check all motor starters and verify that the heater sizing is correct taking length of electrical feeders into consideration. Record amp and voltage

readings on all motors, (all legs) as well as nameplate data.

5. Check-out and align all equipment drives.

6. Set all fan sheaves to provide approximately the indicated capacities.

7. Set all manual balancing dampers, valves, and balancing valves at 100% open position. Verify all fire dampers to be open.

8. Clean interior of all plenums, casings and ducts and install all filters before starting systems.

9. Make sure all control systems are calibrated and functioning properly.

I. Balancing Submittals

1. Data Sheets on Testing Equipment:

   a. Submit data sheets on each item of testing equipment required

   b. Include names of device, manufacturer's name, model number, latest date of calibration, and correction factors.

2. Report Form:

   a. Format per AABC.

   b. Bound 8-1/2" x 11".

   c. Include name of balancing company.

3. Report Content: Include balancing company certification that methods used and results achieved are as specified and reported.

4. Report Content:

   a. Air Balance:

      1) Fans:

         Number, service, model, and size

         Delivery in CFM with system both in 100% O.A. and exhaust and with minimum O.A

         Minimum outside air CFM.

         Static pressure: suction, discharge, and total.

         Voltage: rated and actual.

         Motor amperage: rated and actual.

Motor sheave diameter: adjustable or solid

Fan sheave diameter.

Motor RPM.

Fan RPM.

2) Fans Graphic Plot: For each fan, on its actual fan curve, plot intersections of the following lines:

CFM from transverse.

Static pressure (or total pressure for fans so rated).

Brake horsepower from amperes.

RPM

Position of fans variable adjustment.

3) Filter banks, outside air, return air, and exhaust air CFM's.

4) All supply, exhaust, and return air diffusers and grilles; arrange in following columns:

Outlet location by room number, or other suitable means

Include key plans, if necessary, to identify locations.

Supply/make-up outlet size and type.

Supply outlet design CFM.

Supply outlet actual CFM.

Return or exhaust outlet size and type.

Return or exhaust outlet design CFM.

Return or exhaust outlet actual CFM.

J. Air Balancing:

1. Balance with outside, return, and exhaust air dampers fixed in 100% outside air and 100% exhaust positions. Obtain value of minimum outside air from drawings.

2. Verify proper automatic operation of automatic outside, return, and exhaust air dampers throughout entire range of operation.

3. Balance with filter pressure drop at midpoint between clean and dirty filters. Artificially create required pressure drop, if necessary, by blanking off coils.

4. Balance with doors and windows in their normal, closed position.

5. Balance air to be the following tolerances:

   a. Each outlet: +/-10%.

   b. Each room with multiple outlets: 0% to + 10%.

   c. Each system: 0% to + 10% of system CFM.

6. Balance main exhaust systems to maintain interior building pressure at 0.05" water greater than outdoor pressure. This may require different exhaust or return air quantities than scheduled.

7. Adjust throw patterns of supply air outlets to result in uniform, draft-free room air distribution.

8. System design static pressures are approximations. Make changes in sheaves and belts as required for specific air balance. Final adjustment of sheaves to result in sheave with additional possible adjustment in both directions.

9. Inspect all rooms for room temperatures, drafts, and noise. Make adjustments to correct any problems.

10. Operate each room thermostat to verify correct system response to raising and lowering thermostat set points.

H. Water Balancing:

1. Adjust water systems to provide required or design quantities.

2. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

4. Effect system balance with automatic control valves fully open to heat transfer elements.

5. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

6. Where available pump capacity is less than total flow requirements or

individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.06 OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS:

D. Furnish three (3) complete sets of operating and maintenance instructions for all equipment (of all types) and automatic control systems bound in a hardboard binder and indexed. Start compiling the data upon approval of list of materials. Submit no later than thirty (30) calendar days prior to substantial completion. Final payment will not be made until booklets are approved by Engineer.

E. These sets shall incorporate the following:

1. Complete operating instructions for each item of equipment.

2. Test data and air balancing reports as specified.

3. Typewritten maintenance instructions for each item of equipment listing in detail the lubricants to be used, frequency of lubrication, inspections required, adjustments, etc.

4. Manufacturer's bulletins with parts numbers, instructions, etc., for each item of equipment, properly separated and assembled.

5. Special diagrams and literature that may be required.

6. Diagrams, descriptions and sequence of controls for each system.

7. Include telephone numbers and addresses of service companies.

8. Approved product data submittals.

F. A permanent, non-fade, reproduction (such as a photo copy) of the As-built control and wiring diagrams shall be framed and mounted where directed by the architect/owner.

END OF SECTION 15200

SECTION 15300

FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. The intent of these specifications is to define the fire protection scope of work for a complete and fully functioning facility and to enable the Design-Build Contractor to prepare a bid price to construct the work under a Design/Build process.

These specifications are not intended for construction purposes.

The Contractor shall include in this price all items indicated and/or specified and of work reasonably inferred by these specifications and required for compliance with applicable codes to provide such fully functioning facility with all systems complete. If the Contractor is in doubt as to the intent of any portion of these specifications or suspects necessary information is omitted, then the Contractor shall notify the Architect in writing in sufficient time for the Architect's clarifications or corrections by addendum.

B. The Contractor shall review specifications of all disciplines (i.e., Architectural, Structural, Mechanical, Electrical, etc.), and include all related fire protection work unless specifically excluded.

C. The project will be completed and occupied in multiple phases. The Design-Build contractor shall coordinate the phasing requirements with the owner and the architect and provide all necessary utilities, services, temporary connections, sectionalized valves, plumbing & electrical provisions as necessary for the phased construction and to maintain services to the occupied portion of the building.

D. The project will include solar thermal and Photovoltaic systems on the roof. The Design-Build fire protection contractor shall provide customized sprinkler protection for these areas to provide 100% coverage of all areas and as per the local jurisdiction requirements.

E. Provide U.L. listed and the local water company approved double check detector check valves as necessary to provide adequate Code required flow and pressure based on the available city water pressure.

F. Provide complete fully engineered fire protection system including the wet and dry stand pipes, fire department connections, approved type backflow preventers, post indicator valves, fire hose valves where required both for occupant use and fire fighters use. Provide water motor bells or other electrically operated audible alarms as required by the local jurisdictions.

G. Coordinate with the Division-16 in monitoring of the flow and tamper switches. Coordinate the power requirements for the fire pump and jockey pumps and control panels.

H. Provide permanent identification labels for all fire protection equipment, stand pipe risers, control valves assemblies, main and branch pipes per NFPA and local authority requirements.

I. Coordinate with Division-15 plumbing trade work for providing floor sinks, indirect drainage receptors for fire protection test drains per Code. Test drain piping shall be schedule-40 galvanized steel piping.

J. All exposed piping shall be galvanized schedule-40 steel. All exposed heads shall be corrosion proof type, all heads located in equipment rooms and low head rooms shall be protected with approved type protection guards.

K. Coordinate with architect for fire control valve assembly and fire riser location within the building. Coordinate with structural consultant for sleeving the foundation and slab for bringing in the fire water service line to the room. Comply with City of Livermore Fire Department requirements for quantity and location of fire department connection locations and sprinkler alarm locations.

1.02 SCOPE OF WORK

A. The scope shall include the design of the fire protection work, materials, equipment, fabrication, installation and tests in conformity with NFPA 13, & 14, using the latest edition that the city of Livermore follows, and applicable codes, professionally recognized standards and authorities having jurisdiction as follows:

1. Calculations supporting the design.

2. Submittal of fire protection shop/construction drawings for all City jurisdiction approvals as required for permits and inspections.

3. Shop/Construction drawings and specifications.

B. Related Work

1. Plumbing.

2. Solar Hot Water System

3. Mechanical General requirements

4. Heating, Ventilating and Air-Conditioning.

5. Division-16 - Electrical connections for alarms and tamper switches.

6. Site Fire Protection mains up to 5 feet of the building. Coordinate fire department connection line, backflow preventer location and pumper connection with civil engineer.

1.03 QUALITY ASSURANCE

A. Construction Documents shall be designed/engineered by a registered Professional Engineer licensed by the State of California.

B. Contractor's Qualifications: Duly licensed in the state of California and regularly engaged in design/build installations of Fire Protection systems for similar projects in the local area.

C. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

D. Supply all equipment and accessories new and free from defects.

E. All items of the same given type and size shall be the products of the same manufacturer.

F. Satisfy seismic requirements of the State of California and NFPA 13, latest edition that the City of Livermore follows.

1.04 SUBMITTALS:

A. Detailed engineering calculations, shop drawings and specifications, stamped and signed by a registered Professional Engineer indicating the specific fire protection design for the project, shall be submitted to the Architect for review prior to the ordering of materials and equipment and the installation of the work. The Engineer shall become the Engineer of Record for the project.

Type and arrange specifications in 3 part CSI format, adequately describing the materials, system operations where applicable, and execution of the work.

B. After acceptance of shop drawings and specifications and at a time designated, submit the following shop drawing information to the Architect in an organized manner for all equipment and materials used in the project:

1. Shop Drawings: Shall be scaled layout drawings for fire protection equipment, pipe and fittings including, but not necessarily limited to, pipe and tube sizes, sprinkler head types and locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Indicate interface and spatial relationship between piping and proximate equipment, lighting fixtures, etc.

2. Manufacturer's name, brand name and catalog reference of all equipment and materials supplied. Submit complete material and equipment list prior to submittal of Shop Drawings.

3. Detailed description of items supplied, including specifications, performance characteristics, materials, diagrams and schedules.

4. Seismic calculations stamped by a registered civil/structural engineer.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be shipped in its original packages to prevent damaging or entrance of foreign matter. All handling and shipping shall be performed in accordance with manufacturer's recommendations. Provide protective covers

during construction.

B. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the Architect.

C. All items shall be tagged with a weatherproof tag identifying equipment by name and purchase order number. Packing and shipping lists shall be included.

1.06 DESIGN CRITERIA:

A. General: Based upon latest NFPA 13, & 14, latest edition that the city follows, and its applicable appendices and City of Livermore Fire Department. The system should be hydraulically designed.

B. Areas Covered: Entire building including Rooftop penthouse mechanical rooms and solar panels.

C. Areas Excluded: None.

D. Residential Areas: Light Hazard.

E. Mechanical Equipment Rooms, boiler rooms, pumps rooms, trash rooms & Storage Areas: Ordinary Hazard, Group 1.

F. Other Areas: Per latest NFPA 13.

G. Head Spacing: Per NFPA 13.

H. Flow Rate Densities: Per NFPA 13 area/density.

I. Piping Distribution: Combination system for sprinklers and standpipes.

J. Sprinkler Risers: Sprinkler floor control valve station at each riser shall be provided with a fire department test drain valve. Provide drain connection to building sewer.

K. Fire Department Connection: As required by the local fire department.

L. Standpipe System as required by the City of Livermore and NFPA 14.

M. All system and floor control valves including backflow preventer OS&Y valves shall be supervised.

N. All waterflow indicator and monitor switches shall be connected to the annunciator panels and to a central station signal system.

O. For criteria which is not specified and which may have to be established during design, call attention of such items to Owner and Architect. Establish and document such criteria, with approval of Owner and Architect, consistent with good engineering practice.

P. Provide separate sprinkler subzones for other auxiliary spaces, covered walkways, etc. as required by the owner/architect and/or local jurisdiction requirements.

1.07 RECORD DRAWINGS

A. Maintain complete set of Fire Protection Record Drawings (field drawings) indicated all work installed.

B. At end of project, transfer all changes via CAD (Autocad 2007) and submit one set of plots electronic disk and field drawings to Owner. Mark drawings "RECORD DRAWINGS", dated and signed by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All materials and equipment shall be new and free of all defects, best quality of their respective grades in accordance with these specifications, and packed in their original sealed containers. Materials not specifically mentioned by trade name shall be best quality of their respective grades. Imperfections in manufacture or damage in shipment will be cause for rejection of the work unless corrections are made to the complete satisfaction of the Architect.

2.02 PIPING:

A. Underground: Cast iron piping conforming to ANSI A21.6, 150 PSIG; bituminous external coated, ANSI A21.11, push-on or mechanical joints. ANSI A21.4 cement-mortar interior lining. Provide as required corrosion protection for the pipe and fittings.

B. Aboveground: Black steel, schedule 40, conforming to ASTM A120. Fittings, threaded cast iron conforming to ANSI B16.4, 125 PSIG class. Threads, ANSI B2.1.

C. Pipe supports: Install pipe supports, braces and anchors per NFPA 13, or as required by applicable local codes.

2.03 VALVES:

A. General Service:

1. Manufacturers: Crane, Jenkins, Stockham, Walworth or approved equal U.L. listed. Model numbers given are for Stockham.

2.	Gate Valves	2" and smaller	Fig. B-133
		2-1/2" and larger	Fig. G-634
3.	Check Valves	2" and smaller	Fig. B-319
		2-1/2" and larger	Fig. G-940
4.	Angle Globe		Fig. B-222

B. Alarm Check Valve:

1. Manufacturers: Automatic, Grinnell, Viking or approved substitute. Selection based on Viking.

2. Type: Model F-1 with Model B-3 retard chamber and special alarm trim for remote electric signal.

3. Gong: Model B-3 water motor operated.

2.04 PIPING SPECIALTIES:

A. Manufacturers: Automatic, Grinnell, Marsh, Simplex, Viking, or approved substitute.

B. Gauges: Marsh No.8, 3-1/2" Dial, dial range twice the system working pressure, 1/4" bottom connection, shut off valve. Provide gauges as required by NFPA 13 and at inspector's test valve in the mechanical penthouse.

C. Flow switches: Vane type, with adjustable time delays, UL listed. Each with two contacts for local and remote alarms.

D. Valve supervisory switches: Provide on main and other shutoff valves that can interrupt flow to sprinklers.

E. Electric Alarm: Locate as required by fire authorities.

F. Adjustable nipples:axial field adjustable , UL listed.

G. Other specialty items as required by NFPA 13 or local conditions and codes.

2.05 SPRINKLER HEADS:

A. Manufacturers: Automatic, Grinnell, Reliable, Viking or approved substitute.

B. Areas without suspended ceilings: Automatic 1/2" pendant or upright issue E 165 degree F. rating, rough brass, quick response type.

C. Residential Areas: quick response, residential type, coordinate with the owner and architect regarding the finish

D. Lobbies and Public Areas: Concealed, 165 degrees F. quick response with finish as approved by the Architect.

E. Other areas with suspended ceilings: Automatic 1/2" pendant issue E flush type, 165° F. rating quick response, polished chrome plated with white enamel escutcheon.

F. Submit one sample of each type of heads to Architect for approval.

G. Spare Sprinklers: Provide spare sprinklers, wrenches, and cabinet per NFPA 13.

H. Provide approved type sprinkler protection guards at the parking garage and

other open ceiling areas to prevent damage to the heads.

2.06 PUMPER CONNECTIONS:

A. Manufacturers: Elkart, Powhattan, Standard, Potter-Roemer or approved substitute. Selection based on Potter-Roemer.

B. Wall Type, Polished chrome plated. Coordinate with the Architect for the exact location.

2.07 PIPE HANGERS AND SUPPORTS:

A. Supports and Hangers:

1. Use Super Strut, Unistrut, B-Line, Elcen or Grinnell hangers and structural attachments to properly support the piping system according to good standard practice and according to the manufacturer's recommendations. Minimum safety factor of 5.0.

2. No piping shall have direct contact with the hanging and support system or the structure.

3. Size hangers properly to fit around bare pipe.

4. Use cadmium plated or galvanized hangers, attachments, rods, nuts, bolts and other accessories.

5. Do not use wire, plumber's tape, or other make-shift devices for hangers.

6. Do not burn or weld any structural member without the written approval of the Owner or Architect.

7. No valve or piece of equipment shall be used to support the weight of any pipe for pipes 1-1/2" and larger.

8. Provide a support or hanger close to each change of direction the pipe, either horizontal or vertical.

9. When piping is installed using a trapeze hanger, bolt the pipe to the trapeze using a pipe clamp, strap or "U" bolt. Do not weld the pipe to the trapeze.

2.08 SEISMIC RESTRAINTS:

A. General: Provide seismic restraints per NFPA 13, and applicable codes and standards. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift.

PART 3 - EXECUTION

3.01 GENERAL:

A. Entire Project to be sprinkler protected per NFPA 13 and per City of Livermore Fire Authority requirements.

B. Layout the fire protection system in careful coordination with the approved shop drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.

C. Install pipes fully concealed and to clear all beams and obstructions; do not cut structural members without the approval of the Architect.

D. Check Architectural drawings and drawings of other trades relating to work to verify spaces in which work will be installed. Maintain headroom and space condition to all points. Any equipment , materials, and piping installed in conflict with the dropped ceiling and lights shall be relocated at the direction of the Architect at no additional cost to the Owner.

E. Set and layout work on premises. Base all measurements from approved bench marks and correct setting or work to agree with established lines and levels. Should discrepancy exist between actual measurements and those indicated, notify Architect in writing and do not proceed with work affected until written instructions are received from Architect.

F. Install equipment and piping rigid, secure, plumb, and in true alignment with related and adjoining work. No welding of fire protection materials for attachment or support is permitted.

G. Arrangement: Install equipment and materials with all working parts readily accessible for inspection, repair and removal. The right is reserved to make reasonable changes in locations of equipment prior to roughing-in without involving additional expense to the Owner.

H. Prior to all work of this Section, carefully inspect the existing and installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

I. Provide sidewall heads if required for special areas as directed by the architect at no extra cost to the owner.

3.02 PIPING:

A. Underground piping shall be installed, cleaned and tested per NFPA 24. Terminate Underground service at riser location with flange and spigot piece securely anchored to building wall.

B. Installation: Install aboveground pipe, fittings and hangers in accordance with NFPA Pamphlet No.13, 14 and 20 and local code requirements, including seismic sway and uplift bracing.

C. Reducers: Make reductions in pipe sizes with one piece reducing fitting. Bushings will not be acceptable, except when standard fittings of proper size are not manufactured. Single bushings of the face type will be permitted up to 5% of total number of reducing fittings in system. Where bushings are used, install with outer

face flush with face of fitting opening being reduced.

D. Use no coupling except where length of pipe between fittings exceeds 20 feet.

E. Use flanged fittings on main riser and drain assembly.

F. Provide next to sprinkler main risers a framed printed sheet protected by transparent plastic, safety glass, or plexiglas cover with brief instructions regarding all necessary aspects of sprinkler controls, emergency procedure, etc.

G. Drains: Install main drain at riser and auxiliary drains at all low points in the system on each floor. Install inspector's test drains on sprinkler system at main riser assembly and at most remote high point in the system from the main riser (penthouse mechanical room or as directed by Architect). Use angle type drain valves. Five or fewer trapped heads may be drained through a plugged fitting. Pipe drain valves to discharge, as approved by the Architect and local fire department officials, outside building unless noted otherwise.

H. Sprinkler head clearance between the deflectors and the walls or ceilings, roof decking or roof joists shall be in accordance with the requirements of the NFPA Pamphlet No. 13.

I. Install a hinged chrome plated escutcheon at all visible wall, floor and ceiling pipe penetrations.

J. Thoroughly clean all pipe and maintain in such condition throughout construction. Temporarily cap off plug ends of unprotected pipe.

K. Install unions at connections to equipment, on service side of valves and elsewhere as required or shown to facilitate maintenance.

L. Install dielectric insulating connections between all dissimilar metals unless otherwise indicated.

M. Run all piping generally level, free of unnecessary traps and bends, and arrange to conform to the building requirements and to suit necessities of clearance for other work.

N. Arrange piping and hangers to allow for expansion, contraction, and structural settlement. Do not install piping in contact with the building structure.

O. Make changes in size or direction with manufactured fittings. The use of bushings, reducing flanges, or bending of a pipe is not allowed.

P. Install piping concealed above ceilings, and beneath the floors. Route piping to linear beams, columns, obstructions and the work of other trades.

Q. Provide corrosion protection for all underground piping. Provide Link Seals at all pipe penetrations to prevent water entry into the building.

3.03 CLOSING IN UNINSPECTED WORK:

A. General: Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect.

3.04 FLUSHING, TESTS AND ADJUSTMENTS:

A. After fire sprinkler piping installation has been completed, flush entire system to remove foreign substances under pressure as required under NFPA 13. Continue flushing until water is clear and check to ensure that debris have not clogged sprinklers.

B. Test the installations in accordance with the following requirements and all applicable codes.

1. Notify the Architect at least 7 days in advance of any test.

2. All piping shall be tested at completion of roughing-in, or at other time as directed by the Architect.

3. Furnish all necessary materials, test pumps, gauges, instruments and labor required for testing.

4. Perform all testing in the presence of the following persons: Municipal Inspector, Fire Marshal and the Architect's representative. Test all above and below grade piping at not less than 200 PSIG pressure, unless local Fire Marshal requires stricter tests. Flush and test until accepted all underground piping before connecting above grade piping at riser connection.

C. Perform operational and alarm tests under simulated or actual service conditions, including one test of complete fire protection system installation with all appliances connected.

D. Should any material or work fail in any of these tests, it shall be immediately removed and replaced by new material, and portion of the work replaced shall again be tested by Contractor at his own expense.

E. Instruct Owner's operating personnel during operating adjustment period.

3.05 CERTIFICATES:

A. Submit to Architect all certificates in triplicate indicating approval of work, approval or performance of tests as required and of final inspection issued by Fire Marshal before final acceptance of sprinkler system.

3.06 CLEANING

A. Brush and clean work prior to concealing, painting and acceptance. Clean and

repair soiled or damaged painted exposed work and match adjoining work before final acceptance. Remove debris from inside and outside of material, equipment and structure.

B. Sprinkler Heads: If sprinkler heads are in place prior to painting, cover each head with a small paper bag of a UL approved type, which shall be removed only after painting is complete. After painting is completed, remove bags and clean and polish each head.

C. Clean-up: Upon completion of all work of this section, remove debris created by this work.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The intent of these specifications and supplemental drawings is to define the plumbing scope of work for a complete and fully functioning facility and to enable the Contractor to prepare a bid price to construct the work per the applicable Codes.

The Contractor shall include in this price all items indicated and/or specified and of work reasonably inferred by these specifications and required for compliance with applicable codes to provide such fully functioning facility with all systems complete. If the Contractor is in doubt as to the intent of any portion of these specifications and drawings or suspects necessary information is omitted, then the Contractor shall notify the Architect in writing in sufficient time for the Architect's clarifications or corrections by addendum.

B. The Contractor shall review drawings and specifications of all disciplines (*i.e.*, Architectural, Structural, Mechanical, Electrical, etc.), and include all related plumbing work unless specifically excluded.

C. The project will be completed and occupied in multiple phases. The Contractor shall coordinate the phasing requirements with the owner and the architect and provide all necessary utilities, services, temporary connections, sectionalized valves & dampers, heating and ventilation provision, plumbing & electrical provisions as necessary for the phased construction and to maintain services to the occupied portion of the building.

1.02 SCOPE OF WORK

A. General: The scope shall include the plumbing work, materials, equipment, fabrication, installation and tests in conformity with applicable codes, professionally recognized standards and authorities having jurisdiction as follows:

1. The scope of work indicated on plans and this section shall include but not limited to providing the Domestic Hot & Cold Water systems, storm drain system, sanitary sewer system, natural gas distribution, condensate drainage system for HVAC equipment, interfacing with the solar water heating system, providing make-up water system for all the HVAC, solar and irrigation system and other systems as indicated on plans.

2. All work shall be in accordance with the plumbing code, local jurisdiction requirements, and in accordance with recognized industry standards, ASPE, ASHRAE, etc., California Plumbing Code, T-24 and USGBC/LEED-NC v2.2 requirements.

3. Submittal of coordination drawings and permit drawings for City/State agency approvals as required for permits and inspections including Title 24.

4. USGBC/LEED-NC v2.2 Compliance: Comply with the water efficiency requirements, energy efficiency, indoor air quality and resource/water efficiency, etc for the project. Meet the prerequisites and the selected optional water efficiency targets for the project through providing water efficient plumbing fixtures. See attached LEED point Checklists for the requirements.

5. Preparation of submittal of detailed shop drawings and cutsheets and performance data.

6. Maintain accurate mark-up of as-built conditions and at the end of the project submit final As-built plans in AutoCAD and hard copies per Div-0 & Div-1 requirements.

7. Submit shop drawings to interface with the various phases of the project as required by the architect/owner. Coordinate with other disciplines, for the service size, point-of-connection, inverts, etc. Coordinate the plumbing fixture locations with the architect.

8. Prepare and submit enlarged scale plans (minimum ¼" to 12') at the toilet rooms and water heater rooms, solar water heating equipment room, and at other locations necessary to clearly route all the plumbing piping in relations to the building elements, structure, and other trade work.

B. The scope of work included in the Section shall cover but not limited to the following:

1. Provide all plumbing piping, central gas domestic water heating with circulated hot water and hot water storage tank, and plumbing fixtures and other accessories required to provide complete and working plumbing systems that includes the sanitary sewer system, storm drain system, domestic hot & cold water system, natural gas distribution, make-up water to the mechanical system, connections to the landscape system, etc. Provide hose bibs, water hammer arrestors, trap primers, thermal insulation, hot water temperature control valves, floor drains, roof drains, overflow drains, labeling, etc. as indicated on the drawings.

2. The plumbing contractor shall coordinate all plumbing penetrations in the building foundation, exterior walls, roof members, etc. with the structural engineer prior to submitting the shop drawing. Similarly, all concrete inserts and sleeves necessary for pipe penetration, supporting and bracing the plumbing systems shall be coordinated and placed the slabs are poured.

3. All underground metal plumbing pipes shall be protected from corrosion with proper coating or plastic sleeves.

4. Provide a main shut-off valves for domestic hot and cold water so that during shut down of one building does not affect the other buildings. Locate the isolation valves in an accessible location. This is in addition to the isolation valves provided at the fixture connections.

5. Provide ultra high-efficiency condensing water heater with all accessories including but not limited to condensate neutralizing system, intake and exhaust vents, relief valve discharge piping, insulated water storage tank return water circulation pumps and interconnection with the solar thermal system.

6. Provide floor drains in the public toilet rooms, water heater room, complete with the drains, trap primer connections and sanitary waste and vent connections. Provide roof main and overflow drains, area drains, complete with fixtures, drainage and coordinate locations with the project architect.

7. Provide hose bibs in the toilet rooms and at building exterior as directed by the architect. Outdoor faucets shall be wall flush mounted in brass enclosure with keyed cover.

8. Provide ultra-high-efficiency plumbing fixtures including but not limited to the water closets, waterless urinals, service sinks & faucets, all faucets, hose Bibbs, floor drains, floor sinks, trap primers, roof drains, deck drains, area drains, etc. The plumbing fixtures, faucets and shower model, make, style, finish & type shall be as indicated in the fixture schedule.

9. Provide and install ADA compliant Hi-Lo electric water coolers per architectural drawings. Coordinate with Division-16 for electrical connections.

10. Install owner furnished equipments and provide utility connections to all the owner furnished equipment and appliances such as the drinking water dispensers, water connections to coffee maker and refrigerator, including all the accessories, hoses, isolation valves, pressure regulators, backflow devices, flex connections, etc. required for proper operation of the appliances.

11. Provide gas distribution from PG&E gas meter to water heater, rooftop packaged gas-electric AC units and other equipment indicated on the plans. Provide UL listed earthquake shut off valves at the entry to the building.

12. Provide color coded pipe labeling, valve identification tags, equipment identification tags, etc. for the complete project. Identification system shall be Seton, Brady or approved equal.

13. Provide U.L. listed through penetration assemblies at all fire and smoke rated wall and shaft wall pipe penetrations.

14. Where pipes enter the building from outdoors or underground provide Link Seal type water seals at the wall or floor penetrations to prevent ground water from leaking into the building.

15. Coordinate with the respective tradework and provide drainage connections, floor drains, indirect waste, trap primers and vent connections for sprinkler test drainage system, condensate discharge for AC units and for receiving the condensate from the high-efficiency (condensing type) water heating equipment. Provide acid neutralizing kit for high-efficiency water heaters

before terminating into the building sewage system.

16. Coordinate with plumbing work provided under this division with work of civil trade and landscape work and provide proper interface between the building utilities and the site utilities. Based on the underground utilities available on the streets at the project site, configure the building services with least number of points of connections to the street utilities.

17. Prepare and submit service connection applications for the domestic water, natural gas, fire water, storm drainage and sewer connections with the respective utility agencies and obtain the required services for the building.

18. Provide approved type backflow preventer assembly for the main building water service, and landscape irrigation service. Provide reduced pressure type devices per the local jurisdiction requirements.

19. Provide schedule 40 galvanized steel drain for the sprinkler test drain riser at each stairwell per the sprinkler system consultant requirements and indirectly terminate to sanitary sewer per local jurisdiction requirements.

20. Provide symmons Tempcontrol water tempering valve and hot water temperature maintenance system consisting of properly sized insulated return water pipe loop, aquastatic and outside air temperature control. Alternately, provide heat tracing for 110 deg F water supply to the public lavatory faucets.

1.03 RELATED WORK

1. Heating, Ventilating and Air-Conditioning.

2. Fire Protection.

3. Electrical.

4. Civil: site water, fire, storm and sanitary drainage main and water up to 5 feet of building. Coordinate point of connection with Civil Engineer.

5. Landscape Architecture Work.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 10 years of successful installation experience on projects with plumbing systems work similar to that required for project.

B. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.

C. Supply all equipment and accessories new and free from defects.

D. All items of the same given type and size shall be the products of the same manufacturer.

E. Satisfy the requirements of the latest version of T-24 energy standards in effect and seismic requirements of the State of California.

F. Codes and Standards:

1. Plumbing Code Compliance: Comply with California Plumbing Code and applicable portions of Local Plumbing Code pertaining to selection and installation of plumbing materials and products.

2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil waste and storm drainage systems.

3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.

4. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.

5. CMC Compliance: Fabricate and install natural gas systems in accordance with "California Plumbing Code" and PG&E requirements.

6. CCR Compliance: Comply with applicable State energy regulations and handicap requirements.

7. AGA Compliance: All gas appliances and equipment shall comply with requirements of American Gas Association.

8. USGBC/LEED-NC v2.2 Green Point Checklist and T-24 requirements, City of Livermore Green Ordinance requirements.

9. Requirements of Americans with Disability Act (ADA) and City agencies.

1.05 SUBMITTALS:

A. Prepare and submit equipment cutsheets, manufacturer data, shop drawings, equipment schedules, to the owner/Architect in an organized manner for all equipment and materials used in the project:

a. Manufacturer's name, brand name and catalog reference of all equipment and materials supplied. Submit complete material and equipment list prior to submittal of Shop Drawings.
b. Detailed description of items supplied, including specifications, performance characteristics, materials, diagrams and schedules.
c. Shop drawings, As-builts, O&M manuals, warranty & guarantee.

B. Refer to Division-0 and Division-1 sections for other requirements for the submittal requirements for warranty and guaranty period, equipment start-up and commissioning, T-24 certification requirements, owner training, spare parts, etc.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Equipment shall be shipped in its original packages to prevent damaging or entrance of foreign matter. All handling and shipping shall be performed in accordance with manufacturer's recommendations. Provide protective covers during construction.

B. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the Architect.

C. All items shall be tagged with a weatherproof tag identifying equipment by name and purchase order number. Packing and shipping lists shall be included.

1.07 DESIGN CRITERIA:

A. Soil, Waste and Vent System: Size per 2007 CPC and applicable local regulations.

B. Water Piping: Size piping per CPC Latest Edition. Limit velocities to 6 feet per second and friction loss to no more than 8 ft. per 100 ft for water piping. Limit velocities to 5 ft. per second for hot water piping as required by code.

1. Minimum pressure at remote fixture : 30 PSIG.

2. Maximum pressure : 75 PSIG.

3. Water temperature to Public Lavatories: 110°F (per T-24).

C. Gas Piping: Per 2007 California Plumbing Code.

D. Roof and Overflow Drains: Per 2007 California Plumbing Code for the rainfall rate of 2" per hour.

1.07 RECORD DRAWINGS

A. Maintain complete set of Plumbing Record Drawings (field drawings) indicated all work installed differently from original Contract Drawings

B. At end of project, transfer all changes via CAD (Autocad 2007) and submit one set of plots, electronic disk and field drawings to Owner. Mark drawings RECORD DRAWINGS, dated and signed by the Contractor.

PART 2 - PRODUCTS

2.01 PIPING:

1. Refer to piping schedule on the drawings.

2. High efficiency water heater condensate piping: Provide acid neutralizing system to neutralize the acidic condensate discharge from the high-efficiency condensing type boilers and water heaters prior to terminating to the building sanitary sewer system. Provide approved type (SS or CPVC) piping and fittings for the condensate drainage system.

2.02 VALVES:

A. Provide Jenkins, Stockham, Demco, Grinnell, or Milwaukee. All ball or butterfly valves for general use shall have EPT seats. Valve handles, except in ground, shall be infinite throttling with memory stop.

B. Gate Valves:

1. 1/2" through 2" - Threaded: Stockham Figure B-105.

2. 1/2" through 2" - Sweat: B-109, screw bonnet.

3. 2-1/2" and above - Flanged: Stockham Figure G-623 bronze fitted.

C. Hand Valves:

1. 1/2" through 2" - Ball Valve - Threaded: Stockham Figure S-214-BR-R-T.

2. 1/2" through 2" - Ball Valve - Sweat: Stockham Figure S-214-BR-R-S.

3. 2-1/2" and above - Butterfly Valve: Demco Series NE, lug type. Provide infinite throttling and memory stop handle. Valves to permit removal of piping on either side with valve in place.

D. Balance Valves:

1. 1/2" through 2" - Ball Valve: Same as hand valve.

2. 2" and above - Plug Valve: Homestead Figure 1522 (semi-steel body).

E. Check Valves:

1. 2" and Smaller - Threaded - Stockham Figure B-319.

2. 2" and Smaller - Sweat - Stockham Figure B-309.

3. 2-1/2" and Larger - Flanged - Stockham Figure G-931.

F. Globe Valves:

1. 2" and Smaller - Threaded - Stockham Figure B-13T.

2. 2" and Smaller - Sweat - Stockham Figure B-14T screwed bonnet.

3. 2-1/2" and Larger - Flanged - Stockham Figure G-512.

G. Gas Cocks: Rockwell, Homestead, Matco, or approved substitute, shall be an approved valve for gas service use.

1. 1-1/4" and Smaller: Matco Catalog #58S AGA.

2. 1-1/2" or 2": Rockwell Figure 114, threaded.

3. 2-1/2" to 4": Rockwell Figure 115, flanged.

H. Pump Discharge Check Valves: Mueller, Clow, or approved substitute.

1. 2" and Smaller: Mueller Figure #203BP.

2. 2 1/2" and Larger: Mueller Figure #101AP.

I. Pressure reducing valves (water): Watts, A.W. Cash, Clayton or approved substitute.

1. General purpose (1/2" to 2 1/2"): Cash figure EB-24U with back pass and optional union inlets.

J. Safety and Relief Valves: Kunkle, Crosby, Watts or approved substitute.

1. Constructed, rated, and stamped per ASME. Relief valves for unheated liquids. Safety relief valves for heated liquids.

2. Set pressure: Must not be above the pressure rating of protected equipment.

3. Size and Capacities: Size valves so that maximum energy of protected equipment is released with pressure not exceeding 10% above valve set pressure.

K. Backflow and Anti-siphon Valves: Clayton, Watts, Febco, Hersey or approved substitute.

1. Reduce Pressure Backflow Preventer: Clayton Model RP.

2. Double Check Valve Backflow Preventer: Clayton Model D.

3. Water heater vacuum breaker: Watts Model 36A.

2.03 DOMESTIC WATER HEATER (GAS):

A. Boilers

1. General: Provide 94% efficient or higher domestic water heaters.

a. Manufacturer: Phoenix, A.O. Smith, Lochinvar, Raypak, Teledyne-Laars, high-efficiency type.

b. Approval: AGA approved and listed in California Energy Commission Directory of Certified Water Heater.

2. Construction: All copper heat exchanger, ASME stamped bronze headers for 160 psi. AGA certified and NBS stamped.

3. Accessories and trim:

   a. Temperature and pressure gauges

   b. Draft Diverter

   c. Electric ignition and California code controls

   d. Power supply 115V

   e. Single stage on/off switch

   f. Time-delay pump control

   g. Burner gas cock

   h. Aquastats on/off temperature controls

   i. Safety gas shut-off valve

   j. Flow switch

   k. Gas pressure regulator

   l. Tankstat and control panel wired for remote sensor

   m. Water heater staging Controller with interface with the BMS.

4. Controls: Fully automatic and factory-set modulating gas and operating controls, water heater staging and capacity control. Provide auxiliary contact in boiler panel to interlock remote tank sensors for operating controls of the boilers. Provide adjustable time delay (0-5 min. adjustable time) relay to quick start and delayed shut-down of boiler circulation pump.

5. Start-Up: Provide factory trained personnel for check-out, start-up, adjustment and instruction services.

6. Provide stainless steel double wall water heater flue termination head for above roof per the water heater manufacturer requirements and its' listing.

2.04 EXPANSION TANK:

A. General: Wessel, Amtrol or approved substitute. NSF and California Codes approved.

B. Precharge: 40 PSI.

C. Rating: Maximum working pressure 150 PSI and 200°F.

D. Start Up: Set proper operating pressure as scheduled by filling or removing air.

2.05 CIRCULATION PUMP AND CONTROLS:

A. Circulating Pumps: Bell and Gossett, Taco, Thrush, or approved substitute, all bronze type. Complete with aquastat and timer. All bronze type, in-line, suitable for 140 F applications.

B. Hot Water Circulator Controls: Line voltage immersion thermostat, Honeywell, or approved substitute; set to open at 135°F. and close at 115°F. on domestic hot water return system.

2.06 DRAINAGE AND PIPING SPECIALTIES:

A. Manufacturers: Smith, Josam, Wade, Jonespec, or Zurn. 100% U.S.A manufactured components only.

B. Cleanouts: Provide types and sizes per code and as directed by the Architect

C. Drains and Floor Sinks: Provide types and sizes per code and as directed by the Architect.

D. Trap Primer: Install where required by code. Precision Plumbing Products differential pressure operated.

E. Traps: Provide for drains, floor sinks, floor-mounted service sinks, showers, and similar type fixtures. Provide clean-out plug in all sink P-traps.

F. Water Hammer Arrestor: Provide where flushometer valves are used. Size per manufacturer's recommendations and PDI Standard.

G. Air Chambers: Provide on all cold and hot water connections without a water hammer arrestor, 18" high and diameter same size as supply. Nibco Model 620L.

2.07 FIXTURE SUPPORTS:

A. General: Provide plumbing fixture carriers, supports, and devices to carry loads independently of walls or partitions. Securely bolt supports to floor with powder-driven or drilled inserts or studs.

B. Manufacturer: Josam, Smith, Wade or Zurn. Selection based on J.R. Smith.

C. Water Closets: Fig. 210 Series for all hung type.

D. Wall Hung Lavatories: Fig. 700 Series.

E. Urinals: Fig. 637.

2.08 SPECIALTY EQUIPMENT CONNECTIONS:

A. General: For equipment provided under other sections, or by Owner, requiring piped utility services, rough-in and connect per applicable equipment shop drawings. Investigate actual equipment supplied to determine need for backflow devices. Conceal piping, valves, and piping accessories except where it is mandatory to be exposed. Exposed work polished chrome plated. Provide insulated hot piping with polished stainless steel jacket.

B. Trim Supplied with Equipment: Install items such as faucets, valves, sink drains, safety devices, gauges, thermometers, pressure reducing valves, traps, and control devices.

C. Connections: Provide all required piping, valves, piping accessories, trim, and safety devices, type as listed under appropriate system.

1. Indirect Waste Connections: Copper; drainage, Type M, or DWV.

2. Plumbing P-traps: Equipment Connected to Waste System - provide type listed under "Plumbing Fixtures".

3. Water Connections: Fixture stops and supplies - provide type listed under "Plumbing Fixtures".

D. Refrigerator Cold water valve box: Provide recessed valve box containing cold water stop valve at each refrigerator locations in the kitchen. The box shall be as manufactured by Guy Gray Mfg. Co. or approved equal.

F. Hose Bibb: Zurn, Smith or approved equal, key operated, with integral backflow device.

2.09 PLUMBING FIXTURES:

A. General: Provide factory-fabricated fixtures of type, style and material indicated or as specified. For each type fixture, provide manufacturer's standard trim, carrier, seats, and valves as indicted by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option but all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

B. Manufacturers: Provide fixtures per Paragraph 2.09.K. When not specifically listed provide the following manufacturers.

1. Fixtures: American Standard, Kohler, Eljer, or Crane. Selection based on American Standard unless otherwise noted.

2. Fixture Trim: American Standard, Kohler, Chicago Faucet, or Speakman.

3. Flush Valves: Sloan, Zurn or approved substitute.

4. Water Closet Seats: Olsonite, Church, Sperzel, or Beneke.

C. Vitreous China Fixtures: CS20.

D. Fixture Supplies and Stops:

1. Lavatories: Speedway CRSST-1912-A, or approved substitute.

2. Sinks: Speedway CRSST-1912-K, or approved substitute.

3. Flush Valves: Lockshield key operated stops.

4. Tank water closets: Speedway CRSST-1912-DL.

5. Wall mounted faucets: Screwdriver stops or faucets may have integral stops in lieu of separate stops.

E. Fixture Flow Controls: To comply with Title 24 & Build-it-Green requirements at each fixture as follows. Model numbers are for Dole:

1. Lavatories: Type FMB, 0.5 GPM except faucets with integral 0.5 GPM flow control.

2. Service Sinks: Type SR, 2.2 GPM.

F. Lavatory and Sink Traps: 17 gauge adjustable "P" traps, cleanout plug, tubing to wall. Polished chrome plated.

G. Fixture Color: White.

H. Trim Finish: Polished chrome plated.

I. Handicapped Requirements:

1. All designated fixtures for handicapped shall be installed per California Code of Regulations, Title 24, Part 2, handicapped requirements.

2. Wrap P-Trap, cold and hot water tubing and stops with SKAL+GARD to protect against scalding and scraping.

J. Other Materials:

1. All other materials not specifically described but required for a complete and proper installation shall be new, first quality of their respective kinds, and subject to the approval of the Architect.

K. Plumbing Fixtures Schedule:

1 Drinking Fountain (DF-1): Wall-mounted Dual units for ADA compliance, 18 ga. Type 304 Stainless steel construction, SS back panel, push-button valves, State of California AB-1953 compliant, Polished chrome-plated bubbler heads with integral shield and laminar flow pattern, vandal

resistance design, Haws Model 1011MS or approved equal.

2. Refer to plumbing fixture schedule on drawings for other plumbing fixtures.

2.10 PIPE HANGERS AND SUPPORTS:

A. Supports and Hangers:

1. Use Super Strut, Unistrut, B-Line, Elcen or Grinnell hangers and structural attachments to properly support the piping system according to good standard practice and according to the manufacturer's recommendations. Minimum safety factor of 5.0.

2. No piping shall have direct contact with the hanging and support system or the structure. On pipes that are insulated, run the insulation continuous through the hanger and provide sheet metal shields of proper length and gages under the insulation to prevent crushing. On uninsulated copper piping, use Stoneman "trisolator" or similar Unistrut or Super-Strut device at each hanger or support point.

3. Size hangers properly to fit around bare pipe, isolator, hanger shield, or insulation as required.

4. Use cadmium plated or galvanized hangers, attachments, rods, nuts, bolts and other accessories.

5. Do not use wire, plumber's tape, or other make-shift devices for hangers.

6. Do not burn or weld any structural member without the written approval of the Owner or Architect.

7. No valve or piece of equipment shall be used to support the weight of any pipe for pipes 1-1/2" and larger.

8. Provide a support or hanger close to each change of direction the pipe, either horizontal or vertical.

9. When piping is installed using a trapeze hanger, bolt the pipe to the trapeze using a pipe clamp, strap or "U" bolt. Do not weld the pipe to the trapeze.

10. Provide support to all underground piping, support to be attached to the floor slab. Provide corrosion protection to all underground piping.

11. Provide vibration elimination supports at all the party walls and corridor walls to eliminate noise and vibration transfer to the adjacent space. Provide the sound and vibration eliminators as recommended by the project acoustical consultant.

EQUIPMENT SUPPORTS:

A. All rotating equipment and equipment capable of transmitting vibration into the

space shall be mounted on vibration isolators and bases.

B. Isolators shall be provided for equipment mounted aboveground and as required for controlling the noise & vibration transmission to the structure.

C. The isolators shall be as manufactured by Mason, Kinetics, or Amber-Booth. Other manufacturers not allowed.

2.12 SEISMIC RESTRAINTS:

A. General: Provide seismic restraints per applicable code and standards. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift. Restraints shall not short circuit vibration isolated equipment under normal operation.

B. Requirements:

1. Criteria: Design restraints per SMACNA/PPIC "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", for equipment, and piping.

2. Seismic Force Criteria: 1.0 G

3. Contractor to submit Seismic Restraint calculations that are signed by a structural engineer registered in the State of California. Calculation must confirm the adequacy of the restraints and their anchoring to the building structural elements.

2.13 INSULATION:

A. Pipe Insulation: Type and Thickness:

1. General: In accordance with Title 24 energy regulations.

2. Manufacturers: Owens-Corning, Manville, Certain-Teed, or approved substitute.

3 Domestic Hot Water, (Supply and Return): Premolded fiberglass with ASJ. R-4 minimum.

4. Provide insulation for pipes that are located outdoors to protect against freezing.

5. Horizontal rain water leaders located in an active ceiling plenum shall be insulated to prevent sweating.

6. Where necessary, provide acoustical insulation on the piping as recommended by the acoustical consultant.

2.14 WATERPROOFING AND CORROSION PROOFING:

A. All pipe penetrations to the building exterior walls, floors and footings shall be provided with link seal type sealer to prevent ground water and rain water from entering the building.

B. The exterior wall & roof penetrations shall be similarly flashed and sealed to prevent the rainwater from entering the building.

PART 3 - EXECUTION

3.01 GENERAL

A. Check Architectural drawings and drawings of other trades relating to work to verify spaces in which work will be installed. Maintain headroom and space condition to all points. Any equipment, materials, and piping installed in conflict with the dropped ceiling and lights shall be relocated at the direction of the Architect at no additional cost to the Owner.

B. Set and layout work on premises. Base all measurements from approved bench marks and correct setting or work to agree with established lines and levels. Should discrepancy exist between actual measurements and those indicated, notify Architect in writing and do not proceed with work affected until written instructions are received from Architect.

C. Install equipment and piping rigid and secure, plumb and in true alignment with related and adjoining work. No welding of plumbing materials for attachment or support is permitted.

D. Drawings and Arrangement: Install equipment and materials with all working parts readily accessible for inspection, repair and removal. The right is reserved to make reasonable changes in locations of equipment shown on construction drawings prior to roughing-in without involving additional expense to the Owner.

E. Prior to all work of this Section, carefully inspect the existing and installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

F. Provide adequately sized floor sink in the boiler room and booster pump room with backflow preventer to drain the relief discharge from the system. Similarly, provide adequately sized floor sinks and floor drains in the boiler room.

G. Provide adequately sized roof main drains, overflow drains, deck drains area drains as required and as indicated on the architectural and plumbing drawings.

H. Coordinate termination of storm drain to the site storm drainage system with the project site work and landscape contractors for the point of connection, size, inverts, etc. For storm drains daylighting on the side of the building provide cast brass ornamental escutcheons (J.R. Smith or equal) at the overflow drains that are terminated through the walls in the public areas.

3.02 PIPING INSTALLATION

A. Thoroughly clean all pipe and maintain in such condition throughout construction. Temporarily cap off plug ends of unprotected pipe.

B. Install unions at connections to equipment, on service side of valves and elsewhere as required or shown to facilitate maintenance.

C. Install dielectric insulating connections between all dissimilar metals unless otherwise indicated.

D. Run all piping generally level, free of unnecessary traps and bends, and arrange to conform to the building requirements and to suit necessities of clearance for other work.

E. Arrange piping and hangers to allow for expansion, contraction, and structural settlement. Do not install piping in contact with the building structure.

F. Make changes in size or direction with manufactured fittings. The use of bushings, reducing flanges, or bending of a pipe is not allowed.

G. Install piping full size through shut-off valves, balancing valves, etc. Change pipe size within three pipe size diameters of the final connection to fixtures and equipment.

H. Install piping concealed above ceilings, beneath the floors, or in walls. Route piping to linear beams, columns, obstructions and the work of other trades.

3.03 FIXTURE INSTALLATION AND CONNECTIONS:

A. General:

1. Set fixtures to equal height, plumb, or at right angles to wall. Connect to waste and water supplies in neat, uniform, and finished manner. Provide necessary trim and appurtenances for complete installation. See architectural drawings for fixture heights, spacing, arrangement, etc.

B. Inspection and Preparation:

1. Examine roughing-in work of domestic water and piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

2. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement. Support piping independent of wall construction.

C. Cleaning and Protection:

1. Clean plumbing fixtures of dirt and debris upon completion of installation.

2. Protect installed fixtures from damage during the remainder of construction period.

D. Field Quality Control:

1. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

2. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect. Remove cracked or dented units and replace with new units.

3.04 STERILIZATION OF PIPES:

A. After preliminary purging, cleaning, and flushing of the system, chlorinate the entire potable domestic water system in accordance with the current recommendations of the American Water Works Association and in accordance with all pertinent state and local health codes and regulations.

B. Chlorinate only when prescheduled and provide proper warning signs at outlets.

C. Upon completion of the sterilization, thoroughly flush the entire potable water system and immediately fill the system.

D. When sterilization and flushing are complete, arrange with pertinent agencies for all required tests on mains and systems.

3.05 START-UP SERVICES:

A. Prior to start-up, ensure that the systems are ready, including the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrication, venting, controls, and properly set relief and safety valves.

B. Start and operate all systems. Provide the services of factory trained technicians for start-up of equipment and all systems including but not limited to controls, and pumps.

C. Adjust all balancing valves, controls, fans, flow and pressure regulators, and any other adjustable equipment for optimum performance and to suit job conditions.

D. Personnel performing start-up services shall be fully qualified, experienced, and normally engaged in this type of work. If the Contractor does not have such personnel available from his own company, he shall hire, at his own expense, Subcontractors who are qualified.

E. The Contractor shall designate one field person who is overall responsible for start-up procedures which include testing and balancing. He shall directly supervise the start-up operations and be available for required coordination before, during, and after start-up.

F. A final and complete start-up report shall be submitted prior to final acceptance and payment. This report shall be signed by each person doing the start-up task and by the responsible field person. Report shall include, but not be limited to: date of test, instrument used, date of last calibration, temperatures, set points, rpm, voltage, amperage, pressures, stability, vibration, etc.

G. Submit a signed copy of all test reports to the Architect.

3.06 CLEANING

A. Brush and clean work prior to concealing, painting and acceptance. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance. Remove debris from inside and outside of material, equipment and structure.

B. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

END OF SECTION

SECTION 15900

ACCEPTANCE TESTING AND DOCUMENTATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section describes the Acceptance Testing and documentation of the mechanical system(s) and outlines the duties and responsibilities of the contracting team for Acceptance Testing.

B. The Acceptance requirements shall be applied to all products, equipment and systems provided under this Division, where indicated on plans, and where required by California Title 24 requirements and LEED requirements.

C. The Mechanical Contractor shall engage the services of a firm specializing in commissioning of mechanical systems or shall submit contractor qualifications for review by architect where testing and documentation is to be performed by contractor. Where duct pressure testing validation is required, submit name and qualification for HERS Certified testing agency.

D. Provide fundamental commissioning for all the mechanical, electrical and plumbing systems. Provide all the labour and materials necessary for executing the fundamental commissioning including coordination will all the trade contractors, commissioning plans, commissioning forms, testing calibrating and submitting the test & commissioning forms to the architect. Include adequate manhours for coordination meetings, testing and documentation necessary for the project compliance with appropriate owner chosen LEED and T-24 energy efficiency credit compliance methods.

E. Refer to other requirements in the Dision-1, Division-15, Division16 sections, including the following:

A.	Section 01400	Project Sustainability Requirements
B.	Section 01810	Commissioning
C.	Section 01515	Construction Waste Management

1.02 THE COMMISSIONING TEAM

A. The Commissioning Team shall be formed and consists of:

1. Mechanical contractor's representative.

2. Controls contractor's representative, if required.

3. HERS Certified Testing Agency where required.

4. Commissioning Agent.
5. Owner's staff representative.
6. Air balancing company.
7. General and other trade contractors.

PART 2 - PRODUCTS

2.01 DUTIES OF THE TEAM

A. The duties of the Team are as outlined in the Title 24 & LEED Requirements and summarized below:

1. The mechanical contractor shall plan, organize and implement the Acceptance Testing process and shall within one month of the award of the contract, submit the names and addresses of the Testing team member(s).
2. The Acceptance testing team shall submit a complete description of the testing procedures and systems to be tested to the architect for review.
3. The Acceptance testing team shall co-ordinate all tests of systems and equipment and assemble all documentation related to tests. All documentation relative to tests and proposed procedures shall be submitted to design engineer for review prior to submitting documentation to Authority having jurisdiction. Team shall be responsible for performing data analysis, calculation of performance indices and crosschecking of results with the requirements of Title 24 and the Contract documents. The installing contractor or agent responsible for testing and documentation shall record their State of California Contractor's license number or their State of California Professional Registration License number on each Certificate of Acceptance for submittal.
4. Contractor shall be fully responsible for submitting Certificate of Acceptance including paper and electronic copies of all measurements and monitoring results and all supporting documentation to the Authority having jurisdiction. Where Authority having jurisdiction questions results or requires additional testing, contractor shall complete additional testing and provide required documentation at no additional cost to the Owner.

2.02 TIME SCHEDULE

A. The time period of the commissioning of the systems shall be determined by the general contractor and Acceptance testing team. It is important to note that Authority having jurisdiction will not release a final Certificate of Occupancy until a Certificate of Acceptance is submitted that demonstrates that the specified systems and equipment have been shown to be performing in accordance with the Title 24 standards.

2.03 ACCEPTANCE TESTING – PHASE I - DOCUMENTATION

A. Team shall assemble documentation showing all thermostat and sensor locations, control device locations, control sequences and notes.

B. Per Title 24 requirements, team shall provide record drawings to building owner within 90 days of receiving a final occupancy permit (refer to other specification sections for requirements on record drawings.)

C. Per Title 24 requirements, team shall provide operating and maintenance manuals to the building owner (refer to other specification sections for requirements on operation and maintenance manuals.)

2.04 ACCEPTANCE TESTING – PHASE II – INSPECTION AND TESTING

A. Team shall review the installation, perform acceptance testing and document results for the following systems:

1. Constant Volume Systems
2. Package Systems
3. Air Distribution Systems
4. Economizers
5. Demand Control Ventilation Systems
6. Ventilation Systems
7. Variable Frequency Drive Fan Systems
8. Hydronic Control Systems
9. Supply Water Reset Controls
10. System Programming
11. Time Clocks

B. Review of installation shall confirm mechanical equipment and devices are properly located, identified, calibrated, and set points and schedules programmed per contract document requirements.

2.05 ACCEPTANCE TESTING - PHASE III - CERTIFICATION

A. Team shall document operating and maintenance information, complete installation certificate, and indicate test results on the Certificate of Acceptance, and submit the Certificate to the Authority having jurisdiction prior to receiving final occupancy

permit. Team shall submit forms MECH-1-A through MECH-9-A as required by Title 24 requirements.

PART 3 - EXECUTION

3.01 ACCEPTANCE TESTS AND DOCUMENTATION

Refer to California Title 24, Non-residential manual for specific testing procedures and documentation requirements.

END OF SECTION

SECTION 16000
ELECTRICAL - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 CONDITIONS AND REQUIREMENTS

A. The General Conditions, Supplementary Conditions, and Division 1 - General Requirements of the Contract Documents are hereby made a part of this Section of the specifications as fully as if repeated herein.

1.02 DESCRIPTION OF WORK

A. Provide all labor, equipment and materials that are required to provide power to parking lot and walkway lighting and future two-single story buildings 7800 SF each, as indicated on the drawings and as described in these specifications, including that reasonably inferred for proper execution of work and system operation.

B. Provide cutting and patching as required for execution of work performed under this Section unless specifically provided for, under other Sections.

C. Coordinate with work performed Division 15, in order to accommodate the requirements of this Section, and to assure adequate space and proper location for all necessary work of this project whether or not work is under this Section.

D. Provide all seismic restraints required by code, or by this specification, whichever is more stringent for all equipment and materials furnished under this Section. This Contractor is responsible for the design of the restraints and for proof of adequacy of the restraints.

E. Provide all labor and material required to set and adjust the installation so that it performs in accordance with the design intent included in the Drawings and these Specifications.

1.03 CODES AND REGULATORY REQUIREMENTS

Follow applicable version of the following codes and regulations:

CBC	2007 California Building Code
CEC	2007 California Electric Code
CFC	2007 California Fire Code
CA Title 24	2007 Energy Efficiency Standards for Non-Residential Buildings.
NEC	National Electrical Code - Latest Edition
ANSI Std. 241	Recommended Practice for Electric Power Systems in Commercial Building (IEEE Gold Book).
ANSI Std. 493	Recommended Practice for Design of Reliable Industrial and Commercial Power Systems (IEEE Gold Book).
ANSI Std. P-1110	Recommended Practice for Powering and Grounding Sensitive

Electronic Equipment (IEEE Emerald Book).
American with Disabilities Act (ADA).
PGE Greenbook 2008/2009 Version

1.04 QUALITY ASSURANCE

A. All equipment shall conform to the National Electrical Manufacturer's Association Standards, and shall bear Underwriter Laboratories label where applicable.

B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of the specified products, of types, materials, and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.

C. Contractor's Qualifications: Regularly engaged in construction on projects of similar sizes using types of equipment, material and methods as specified herein - for minimum of 5 years. A letter from the Contractor certifying these qualifications must be provided to the Owner before signing the construction contract.

D. By accepting to perform the work under this contract, the Contractor agrees that he has understood the intent of the design and is reasonably sure that it can be accomplished by proceeding in accordance with these Drawings and Specifications.

1.05 DRAWINGS AND SPECIFICATIONS

A. Consider all drawings and all Divisions of this Specification as a whole and provide work of this Division shown anywhere therein.

B. Absolute accuracy of the Drawings and Specifications is not guaranteed. While reasonable effort has been made to coordinate the location of equipment and materials with the structure and other trades, it is the responsibility of this Contractor to coordinate exact requirements and locations as governed by actual job conditions, manufacturer's recommendations etc. Check all information and report any discrepancies to the Owner before fabrication or purchasing any equipment and in time to avoid unnecessary work or project delays.

C. Drawings:

1. For purposes of clarity, legibility, drawings are essentially diagrammatic to extent that many offsets, bends, special fittings, exact locations of items are not indicated, unless specifically dimensioned.
2. Exact routing of wiring and locations of outlets, panels, etc. shall be governed by structural conditions, obstructions. Contractor shall make use of data in Contract Documents. In addition, the Owner reserves the right, at no increase in price, to make any reasonable change in location of electrical items and those exposed at ceiling and/or on walls, to group them into orderly relationships and/or to increase their utility. Division 16 shall verify Owner's requirements in this regard prior to roughing-in.
3. All branch circuit conduits to contain minimum two wires plus a ground or as

noted adjacent to branch circuit symbols on Drawings.

4. All wires are no. 12 except as noted on Drawings, or noted hereinafter, or as noted under "Wire", as specified hereinafter
5. Dimensions, location of doors, partitions, similar physical features shall be taken from the Civil Drawings, verified at site by this Division.
6. Mounting heights of brackets, outlets, etc., shall be as required by equipment to be installed or specified on Electrical drawings and/or as noted elsewhere. Submit any cases, which are not clear to Architect for clarification in advance of construction.
7. The general arrangement and location of wiring and equipment is shown on Electrical drawings, and shall be installed in accordance therewith, except for minor changes required by conflicts with the work of other trades.

D. Coordination:

1. Become familiar with conditions at the jobsite, and with the mechanical, plumbing, landscape and architectural drawings and specifications, and plan the installation of the electrical work to conform with that shown and specified, so as to provide the best possible assembly of the combined work of all trades.
2. Work out all "tight" conditions involving work under this Division and work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review, showing all work in "tight" areas. Provide supplementary Drawings, additional work necessary to overcome "tight" conditions, at no increase to construction costs.
3. Provide templates, information and instructions to other Divisions, to properly locate holes and openings to be cut or provided for Electrical Work.

E. Equipment Rough-In:

1. Rough-in locations shown on Electrical Drawings for equipment furnished are approximate only. Rough-in locations shall be reviewed in the field.
2. Obtain exact rough-in locations from following sources:
   a. From shop drawings for switchgear manufacturer and PG&E shop drawings.
   b. Vendor's shop drawings.
3. Verify connection requirements of equipment with Construction Documents before starting rough-in.

F. Measurements:

1. Before ordering any material or closing in any work, verify all measurements on the job. Any differences found between dimensions on the drawings and actual measurements shall be brought to Owner's attention for consideration before proceeding.
2. Verify that all equipment will fit through building openings for movement to final place of installation.

1.06 SUBMITTAL DATA

A. General:

1. Contractor is required, within thirty (30) days of awarding the Contract, to submit product data and shop drawings for all work in accordance with the General Conditions Section 01330 and as outlined in this paragraph, the more restrictive or extensive requirement shall govern.
2. Contractor shall review all submittals prepared by his suppliers and mark all copies as acceptable to him. This acceptance shall construe that all required service connections are shown and in the proper location to meet the installation requirements and that the equipment can fit in the space allowed.
3. Do not order equipment until submittals have been reviewed and approved by the Owner or Owner's representatives.
4. Each item submitted shall be labeled or identified the same as on the drawings.
5. Mark submittal "Exactly as Specified" or accompanied by a letter from the supplier explaining in detail what difference, if any, exists between the submitted item and the specified item. Failure to point out the differences will be considered cause for disapproval. The Engineer will not assume any responsibility for differences concealed or otherwise not brought to their attention, and the Contractor will be required to correct any deficiencies or differences discovered at a later date, and assume responsibility for any delays, damage, and/or expenses incurred by others due to such action.
6. Brands or trade names are mentioned to set standards of quality only; use no substitute materials, however, unless approved in writing by the Owner. Approval of substitute materials does not relieve the Contractor of responsibility for providing a workable and functioning system as designed.
7. Submittals will be checked for general conformance with the design concept but acceptance by the Owner in no manner is meant to verify that dimensions, quantities, or location of services are as necessary to meet the job requirements. This remains the responsibility of the Contractor.

B. Product Data:

1. Submit manufacturer's specifications, data sheets, certified drawings, and installation instructions for equipment, materials, and fixtures specified. Include physical and performance data such as weights, sizes, capacities, required clearances, acoustical characteristics, finishes, color selection, and accessories.
2. Submit all items from each section of the work at one time, if possible, but do not

delay submittals for lack of one or two items.

3. Prepare binders for product data, brochures, catalog cuts, etc., in the following sequence:
   a. Index sheet (with each item cross-identified with reference to contract documents and the divider tab number).
   b. Divider Tab #1 (with item identification).
   c. The brochure, product data sheet, or catalog cut for the item.
   d. Repeat items b and c above for each item of the submittal.

C. Shop Drawings:

1. Prepare and submit plans, sections, details and diagrams to required scales for specified areas. Drawings shall be coordinated, dimensioned and indicate equipment, pipe, duct, fire protection, structural elements and electrical in relation to and structural features. Include minor piping, drains, air vents, etc. Indicate exact locations and elevations of all lighting, conduit, access doors, etc. Highlight any deviations in work from what is indicated on the contract drawings.
2. Required Drawings - Electrical: Submit drawings, minimum scale 3/8"=1'-0" unless otherwise noted for the following:
   a. Main Switchboard MS2 showing switches, breakers, wiring, fuse sizes, interconnection diagram, cabinet arrangement and sizes to PG&E.

D. Review and Resubmissions:

1. Submittals may be returned marked "No Exceptions Taken" or "Exceptions Taken" in which case, resubmittals are not required, and will not be accepted.
2. Correct and resubmit in the original quantities required all submittals marked "Exceptions as Noted".
3. Submittals marked "Not Acceptable" are so marked because the submittal is either as incorrect, incomplete, or illegible as to prevent review; or contains inferior product not complying with the Specifications. Resubmit rejected submittals only after appropriate corrective measures are taken or equal product substituted.
4. Submittals marked "Not Reviewed" shall indicate extra submittals that were not required to be submitted in the first place. This action does not imply acceptance or rejection and Contractor remains obligated to ensure that the product meets drawings and Specifications.
5. Identify all resubmittals as being resubmittals and identify with the original Owner's transmittal number.

1.07 SUBSTITUTIONS

A. General:

1. Submit product options and substitutions as specified herein.
2. Where possible, more than one manufacturer or vendors are listed for acceptable materials and/or equipment to be used in the work. The material and/or equipment of one of the manufacturers or vendors may be cited and specified by model name, number, or description as the established standard. Bids shall be based on using one of the specified brands. The term "products" used below refers to materials and equipment.
3. Adjacent materials and systems have been designed and detailed to accommodate the established standard manufacturer's products. If one of the other approved manufacturers is selected by the Contractor, the Contractor shall design and detail all changes in all adjacent materials necessary to accommodate the selected products, and when approved, shall make such changes to his and other trades' work at no extra cost to the Owner. If additional work is required of Owner or Owner consultants as a result of the substitution, Contractor shall be responsible for the cost of such work.

B. Substitutions:

1. The successful bidders may, within 30 calendar days after award of contract, propose a substitution of a material or apparatus other than those specified. Proposal shall be in writing and shall include change in price, description, and specification data. The Owner shall be the sole judge as to the merits of the proposed substitute and reserves the right to accept or reject it based on price, quality, past performance or delivery, etc. and Owner's decision can not be challenged. Substitution proposals made after 30 days after award of contract will not be accepted.
2. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the established standard must be supplied.
3. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for substitution.
4. If changes to adjacent materials are required to accommodate a substituted product, all the requirements of A.2. and A.3. above apply.

1.08 SPACE REQUIREMENTS

A. Consider all space requirements for all work indicated in the contract documents and subsequent drawings before installing any portions of the work. Space conflicts which occur during or after installation of work, caused by failure to consider all such requirements, shall be resolved by the Contractor to the satisfaction of the Owner at the Contractor's expense.

B. Install equipment and materials with all working parts readily accessible for inspection, repair, and renewal. The right is reserved to make reasonable changes in locations of equipment on the drawings prior to rough-in without involving additional expense to the

Owner.

C. Confer with the Owner to establish exact locations, mounting heights, and arrangements of all electrical outlets prior to roughing in.

1.09 WORKMANSHIP AND MATERIALS

A. Workmanship shall be first class throughout and performed only by competent and experienced workmen in a manner satisfactory to the Owner. Constant supervision of the work, either by the Contractor or his competent representative, shall be maintained.

B. Work shall be performed so as not to delay the progress of construction and shall be properly coordinated with other trades.

C. Use only new materials in perfect condition. Inspect all materials upon arrival at job site and immediately remove defective items from site.

1.10 CUTTING AND REPAIRING

A. Include all cutting and repairing necessary and required for this installation that is not covered by other trades. Structural members shall not be cut except with the written approval of the Owner. Repairing shall be performed by workmen skilled in the trades involved in a manner satisfactory to the Owner.

1.11 NOISE AND VIBRATION

A. The limiting of transmission of noise and vibration is extremely important. This Contractor is to pay particular attention that conduit and equipment are installed so as not to rattle or touch or rub against other materials, equipment, and the building structure. Provide isomode pads, insulation, or other suitable materials to avoid direct contact. Consider, in particular, proper shields at hangers and conduit penetrations of walls and floors.

1.12 TESTING AND ADJUSTING

A. Upon completion of the work, test and regulate all systems to the intent of their design and to the Owner's satisfaction. Furnish the Owner a binder of the equipment data and instruct its representatives as to the proper operation of all systems.

B. Schedule and coordinate all testing and adjusting with the Owner.

1.13 FINAL OBSERVATION

A. The Owner shall make final observation of the job and note unacceptable items in a punch list. Final acceptance shall not be made until all items on this list have been corrected and until all functional performance tests are successfully completed by the Owner.

1.14 GUARANTEE/WARRANTY

A. All materials, parts, equipment, modifications made, and workmanship shall be guaranteed for a period of one year from date of acceptance of the work.

B. Submit all guarantees/warranties as required.

1.15 RECORD DRAWINGS

A. Record of job progress: keep an accurate, dimensioned record of the as-built locations of all work. Keep an up-to-date on blueline prints as the job progresses and make them available for inspection at all times.

B. A set of final as-built reproducible drawings and in ACAD 2004 or later format electronic files saved in CD-rom or DVD-rom shall be submitted to the Owner prior to final acceptance of the Project. The drawings shall be done in drafting standards acceptable to the Owner. These shall include, but not limited to the following:

1. Position of all buried or concealed conduits accurately dimensioned, both horizontally and vertically.
2. All electrical plans.
3. Riser diagrams

1.16 OPERATION MANUALS AND MAINTENANCE INSTRUCTIONS

A. Furnish three (3) complete sets of operating and maintenance instructions for all equipment (of all types) and control systems bound in a hardboard binder and indexed. Submit no later than thirty (30) calendar days prior to Substantial Completion.

B. In addition to specific requirements specified in the various sections of work, incorporate the following:

1. Complete operating instructions for each item of equipment.
2. Test data and other reports that may be specified.
3. Manufacturer's bulletins with parts' numbers, instructions, etc., for each item of equipment, properly stripped and assembled.
4. Special diagrams and literature that may be required.
5. Include telephone numbers and addresses of service companies.

1.17 INSTRUCTIONS AND TRAINING

A. The Contractor shall schedule and conduct comprehensive training sessions for the Owners to help them understand the systems and operate and maintain each major piece of equipment.

B. The Contractor shall attend all training sessions and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.

C. The Contractor shall make the factory approved, manufacturer's representatives available, whenever scheduled by the Owner, to provide the detailed instructions on each major piece of equipment and automation/control system. The manufacturer's representatives shall instruct the Owner as well as shall provide hands on explaining and demonstration of their respective equipment. These training sessions shall be as shown in all other respective sections and shall cover but not limited to the following:

EQUIPMENT		Minimum Training Session
1.	New Main Service Switchboard #2	1 hour
2.	Time Switch Controller	1 hour

PART 2 - MATERIALS

2.01 UNIFORMITY

A. All items of similar nature shall be by the same manufacturer. Trim for major items shall be furnished by the same manufacturer as the item.

2.02 SEISMIC RESTRAINTS

A. General: Provide seismic restraints per applicable code and standards. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift. Restraints should not short circuit vibration isolated equipment under normal operation.

B. Requirements:
1. Criteria: Design restraints for conduit and equipment per SMACNA 1991 Edition, "Seismic Restraint Manual Guidelines for Mechanical Systems" or any similar pre-approved hanger manufacturer's details. Submit required structural calculations for rigidly and flexibly attached equipment.
2. Seismic Force Criteria:
   a. Rigidly Attached 0.5 G.
   b. Flexibly Attached 1.0 G.
3. Restraint to include the following:
   a. Floor mounted equipment

4. Contractor to submit Seismic Restraint calculations that are signed by a structural engineer registered in the State of California. Calculation must confirm the adequacy of the restraints and their anchoring to the building structural elements.

PART 3 - EXECUTION

3.01 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Owner.

3.02 EQUIPMENT INSTALLATION

A. Position equipment to result in good appearance, easy access to all components for maintenance. Install the accessories so that they do not interfere with equipment access.

B. Install equipment level, secure, and out of moisture. Provide shims, anchors, support straps, angles, grouted bases, etc. as required to accomplish this.

C. Use only galvanized screws, nuts, bolts, rods and washers or where required stainless steel. After fabrication, hot dip galvanized unfinished ferrous items for outdoor use or other areas subject to moisture.

D. Start Up: Secure the services of the manufacturer's representative to start up all equipment where specified and which is special and for which Contractor's personnel does not have adequate experience with. All start up shall be prescheduled and coordinated with the Owner and must be witnessed by him.

E. Manufacturer's Directions: Follow the manufacturer's directions where these directions cover points not included on Drawings or in Specifications.

3.03 IDENTIFICATION

A. Properly identify main switchboard, panelboard, time switch control devices and other equipment provided under this Division by means of engraved laminated plastic descriptive nameplates 3/8 inch high white lettering on black for panel/equipment designation including panel/equipment voltage in ¼" high lettering. Mount nameplate using pop-rivets or screws, clamp holders in any form are not acceptable.

B. Properly identify all field devices (i.e. receptacles, switches, junction boxes, lighting, motors, and any other load). These shall be clearly labeled with panel and circuit designation. Provide screwed phenolic labels with 1/4 "block black lettering on white background. Hand letter and /or permanent markers are NOT ALLOWED.

C. Identification of Pull Boxes and Junction Boxes:

1. For Power Feeders:
   a. Stencil cover with identifying circuit number.
   b. Lettering 1" high.

c. Color of lettering, black.
d. Place lettering on cover in neat manner; run parallel to long sides of box.

2. For Branch Circuits, Grounding and Control Systems:
   a. Location: Entire cover.
   b. Color Coding: Per ANSI Z53.1.

D. Identification of Conduits and Raceways:

1. Power Feeders:
   a. Stencil voltage and phase within 10' of all pull boxes, change of direction and terminations.
   b. Letter 1" high.
   c. Color of Lettering:

120/208V - Normal: Black with 1" wide Blue band for normal systems.

E. Provide laminated plastic nameplates, minimum engraved lettering shall be ¼" high white on red matte finish.

3.04 WATERPROOF CONSTRUCTION:

A. Maintain the waterproof integrity of penetrations through materials intended to be waterproof. Provide flashings at exterior wall and roof penetrations. Caulk watertight penetrations of foundation walls and floors. Provide membrane clamps at penetrations of waterproof membranes.

3.05 ADJUSTMENTS TO SYSTEMS:

A. Adjust all equipment and system components as scheduled on drawings, or as required, to result in the intended system operation.

B. Thereafter, as a result of system operation or as directed by the Owner, make readjustments as necessary to refine performance.

3.06 PRELIMINARY OPERATION:

A. Operate any portion of the installation for the Owner's convenience if so required by the Owner. Such operation does not constitute acceptance of work as complete. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is required by the Owner.

3.07 START-UP SERVICES:

A. Coordinate and schedule all start-up work with Owner.

B. Prior to start-up, ensure that the systems are ready, including the following: Proper wiring and auxiliary connections.

C. Start and operate all systems. Provide the services of factory trained technicians for start-up of major equipment and all systems including but not limited to electrical distribution equipment, standby electrical equipment and lighting controls.

D. Adjust all adjustable equipment for optimum performance and to suit job conditions.

E. Personnel performing start-up services shall be fully qualified, experienced, and normally engaged in this type of work. If the Contractor does not have such personnel available from his own company, he shall hire, at his own expense, Subcontractors who are qualified.

F. The Contractor shall designate one field person who is overall responsible for start-up procedures. He shall directly supervise the start-up operations and be available for required coordination before, during, and after start-up. The same person shall assist the Owner in testing and verification of design intent.

G. A final and complete start-up report shall be submitted prior to final acceptance and payment. This report shall be signed by each person doing the start-up task and by the responsible field person.

H. Contractor shall be responsible for utility system shutdowns and start-ups. Coordinate with PG&E.

END OF SECTION

SECTION 16011
ELECTRICAL ACCEPTANCE TEST

PART 1 - GENERAL

1.01 SUMMARY:

A. This Division 16 shall engage the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified.

B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

C. It is the purpose of these tests to assure that all tested electrical equipment, both Contractor and Owner-supplied, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

D. The tests and inspections shall determine suitability for energization.

E. The test shall include only the equipment and devices installed. An itemized description of equipment to be inspected and tested is as follows:

1. Cables
2. Switches - Low Voltage
3. Circuit Breakers - Low Voltage
4. Grounding Systems
5. Motor Control

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16111 - Conduit
3. Section 16120 - Wire and Cable
4. Section 16130 - Boxes
5. Section 16140 - Wiring Devices
6. Section 16170 – Grounding
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein:

1. National Electrical Manufacturer's Association - NEMA
2. American Society for Testing and Materials - ASTM
3. Institute of Electrical and Electronic Engineers -IEEE
4. International Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-1991
5. American National Standards Institute - ANSI C2: National Electrical Safety Code
6. Federal, State and local codes and ordinances
7. Insulated Cable Engineers Association - ICEA
8. Association of Edison Illuminating Companies - AEIC
9. Occupational Safety and Health Administration - OSHA
10. National Fire Protection Association - NFPA
    a. ANSI/NFPA 70: National Electrical Code
    b. ANSI/NFPA 70B: Electrical Equipment Maintenance
    c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
    d. ANSI/NFPA 78: Lightning Protection Code
    e. ANSI/NFPA 101: Life Safety Code

B. All inspections and tests shall utilize the following references:
1. Project design specifications
2. Project design drawings
3. Project short-circuit and coordination study
4. Manufacturer's instruction manuals applicable to each particular apparatus.
5. Project list of equipment to be inspected and tested

1.04 QUALIFICATIONS OF TESTING FIRM

A. The testing firm shall be a testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full Member company of the InterNational Electrical Testing Association.

D. The lead, on-site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

E. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

F. The testing firm shall submit proof of the above qualifications with bid documents, when requested.

G. The terms used herewith, such as test agency, test contractor, testing laboratory, or contractor test company, shall be construed to mean the testing firm.

H. Qualified Testing Agencies:

1. Electro-test, Inc. (800) GO-TO-ETI (www.electro-test.com)
2. Power Systems Testing Company (510)783-5096 (www.powersystemstesting.com)

1.05 DIVISION OF RESPONSIBILITY

A. The Contractor shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. This Division 16 shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

C. This Division 16 shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. The Contractor shall supply a short-circuit analysis and coordination study, a protective device setting sheet, a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.

E. The testing firm shall notify the Architect prior to commencement of any testing.

F. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported to the Architect.

G. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.

H. Safety and Precautions

1. Safety practices shall include, but are not limited to, the following requirements:
   a. Occupational Safety and Health Act
   b. Accident Prevention Manual for Industrial Operations, National Safety Council
   c. Applicable state and local safety operating procedures

d. Owner's safety practices
e. National Fire Protection Association - NFPA 70E
f. American National Standards for Personnel Protection

2. All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.
3. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

1.06 GENERAL

A. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.
2. Selection of metering equipment should be based on knowledge of the waveform of the variable being measured. Digital multi-meters may be average or RMS sensing and may include or exclude the dc component. When the variable contains harmonics or dc offset and, in general, any deviation from a pure sine wave, average sensing, average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.
3. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.
4. Accuracy of metering in test equipment shall be appropriate for the test being performed.
5. Wave-shape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

B. Test Instrument Standards

1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:
   a. Maintained in good visual and mechanical condition
   b. Maintained in safe operating condition
2. Test equipment should have operating accuracy equal to, or better than, the following limits:
   a. Portable multimeters should be true RMS measuring.
   b. Multimeters should have the following accuracy limits, or better:
      1) AC voltage ranges: .75% +/-3 last single digits @ 60 Hz
      2) AC current ranges: .90% +/-3 last single digits @ 60 Hz, including adapters, transducers
      3) DC voltage ranges: .25% +/-1 last single digit
      4) DC current ranges: .75% +/-1 last single digit
      5) Resistance ranges: .50% +/-1 last single digit
      6) Frequency range: .10% +/-1 last single digit @ 60 Hz
   c. Clamp-on ammeters: ac current +/-3% of range +/-1 last single digit @ 60 Hz
   d. Dissipation/power factor field equipment
      1) +/-0.1% power factor for power factor values up to 2.0%

2) 5% of the reading for power factor values above 2.0%

e. Low-range dc resistance equipment: 1.0% of reading, +/-2 last single digits

f. Transformer turns-ratio test equipment: 0.5% or better @ 60 Hz

g. Ground electrode test equipment: +/-2% of range

h. Insulation test sets: 0-1000V dc +/-20% of reading at mid-scale

i. Electrical load survey equipment
   1) +/-5% total error, including sensors
   2) 1% resolution
   3) Current transformers +/-2% of range @ 60 Hz
   4) Voltage transformers +/-0.5% of range @ 60 Hz

j. Liquid dielectric strength test equipment: +/-2% of scale

k. Infrared scanning equipment: sensitivity of 2oC

l. Phase shifting equipment: +/-1.0o over entire range

m. High-current test equipment: +/-2% of range

n. DC high potential test equipment: +/-2% of full scale

o. AC high potential test equipment (60 Hz): +/-2% of full scale

C. Test Instrument Calibration

1. The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instruments shall be calibrated in accordance with the following frequency schedule:
   a. Field instruments: 6 months maximum
   b. Laboratory instruments: 12 months
   c. Leased specialty equipment: 12 months
      (Where accuracy is guaranteed by lessor)
4. Dated calibration labels shall be visible on all test equipment.
5. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
6. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument.
7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

D. Test Report

1. The type written test report shall include the following:
   a. Summary of project
   b. Listing of equipment tested
   c. Test results
   d. Recommendations
2. Furnish copies of the complete type written report to the Architect as directed in the contract documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSPECTION AND TEST PROCEDURES

A. Switches - Low-Voltage

1. Visual and Mechanical Inspection
   a. Compare equipment nameplate information with single-line diagram.
   b. Inspect for physical and mechanical condition.
   c. Check for proper anchorage and required area clearances.
   d. Perform mechanical operation tests.
   e. Verify fuse sizes and types are in accordance with drawings.
   f. Check blade alignment.
   g. Check each fuse holder for adequate mechanical support of each fuse.
   h. Inspect all bus or cable connections for tightness by using calibrated torque wrench. Refer to manufacturer's instructions or Table 4.0.A for proper torque levels.
   i. Test all electrical and mechanical interlock systems for proper operation and sequencing.
   j. Clean entire switch using approved methods and materials.
   k. Check proper phase barrier materials and installation.
   l. Lubricate as required.
   m. Exercise all active components.
   n. Inspect all indicating devices for proper operation.
2. Electrical Tests
   a. Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground for one (1) minute. Test voltage and minimum resistances should be in accordance with Table 4.0.B.
   b. Perform contact-resistance test across each switch blade and fuse holder.
3. Test Values
   a. Bolt-torque levels shall be in accordance with Table 4.0.A unless otherwise specified by manufacturer.
   b. Minimum insulation resistance shall be in accordance with Table 4.0.B or manufacturer's recommended minimum.
   c. Determine contact resistance in microhms. Investigate any values which deviate from adjacent poles or similar switches by more than fifty percent (50%).

E. Circuit Breakers - Low-Voltage

1. Visual and Mechanical Inspection: Molded Case
   a. Circuit breaker shall be checked for proper mounting, conductor size and

feeder designation.

b. Operate circuit breaker to insure smooth operation.

c. Inspect case for cracks or other defects.

d. Check tightness of connection with torque wrench in accordance with manufacturer's recommendations.

2. Electrical Tests:

a. Contact resistance shall be measured.

b. Time-current characteristic tests shall be performed by passing 300 percent rated current through each pole. Trip time shall be determined.

c. Instantaneous pickup current shall be determined by run-up or pulse method. Clearing times should be within four cycles or less.

d. Insulation resistance shall be determined pole to pole, across pole and pole to ground. Test voltage shall be 1,000 volts D.C.

e. Test Values:

1) Contact resistance shall be compared to adjacent poles and similar breaker. Deviations of more than 50 percent shall be investigated.

2) Insulation resistance shall not be less than 50 megohms.

3) All trip times shall fall within Table F.1. Circuit breakers exceeding maximum 300 percent time (column 5) shall be replaced.

4) Instantaneous pickup current levels should be within 29 percent of manufacturer's published values.

TABLE F.1
Values for Overcurrent Trip Test
(at 300 Percent of Rated Continuous Current of Breaker)

Tripping Time,Seconds

Minimum Maximum

Voltage, Volts Range of Rated Continuous Current, Amperes Thermal Breakers Magnetic Breakers Maximum Tripping Times For Cable Protection
(1)(2)(3)(4)(5)(6)
240 50 - 100 5 - 70 200
60015 - 455 5 80100
240110 - 22510 5200300
600110 - 22510 - 200300
600 250 - 45025 - 250300
600500 - 60025 10 250300
600 700 - 1,200 2510 450600
600 1,400-2,5002510 600 750

*These values are based on heat tests conducted by circuit breaker manufacturers on conductors in conduit. NEMA reference.

F. Grounding Systems

1. Visual and Mechanical Inspection
   Inspect ground system for compliance with drawings and specifications.
2. Electrical Tests (Small Systems)
   Perform ground-impedance measurements utilizing the fall-of-potential method per ANSI/IEEE Standard 81 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System." Instrumentation utilized shall be as defined in Section 12 of the above guide and shall be specifically designed for ground impedance testing. Provide sufficient spacing so that plotted curves flatten in the 62% area of the distance between the item under test and the current electrode.
3. Electrical Tests (Large Systems)
   When sufficient spacing of electrodes per 3.01.J.2 is impractical, perform ground-impedance measurements utilizing either the intersecting curves method or the slope method. (Ref. Nos. 40 and 41 in IEEE Std. 81.)
4. Equipment Grounds
   Utilize two-point method of IEEE Std. 81. Measure between equipment ground being tested and known low-impedance grounding electrode or system.
5. Test Values
   The main ground electrode system impedance-to-ground should be no greater than 0.1 ohms. Equipment grounds, depending on size and length of grounding conductor, should be only fractionally higher than system ground.

G. Motor Control

1. Visual and Mechanical Inspection
   a. Inspect for physical damage, proper anchorage, and grounding.
   b. Inspect equipment for compliance with drawings and specifications.
   c. Motor-running protection
      1) Compare overload heater rating with motor full-load current rating to verify proper sizing. (Adjust as necessary if power factor correction capacitors are connected on load side of heaters.)
      2) If motor-running protection is provided by fuses, verify proper rating considering motor characteristics and power-factor correction capacitors if applicable.
      3) Check tightness of bolted connections using calibrated torque wrench.
2. Electrical Tests
   a. Insulation tests:
      1) Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for one (1) minute. Test voltage shall be in accordance with Table 4.0.B.
      2) Measure insulation resistance of each starter section phase-to-phase and phase-to-ground with the starter contacts closed and the protective device open. Test voltage shall be in accordance with Table 4.0.B.
      3) Measure insulation resistance of each control circuit with respect to ground. Refer to Table 3.01.A and Section 3.01.L.2.

b. Test motor overload units by injecting current through overload unit and monitoring trip time at three hundred percent (300%) of motor full-load current.
NOTE: Test times will, in general, be longer than manufacturer's curve if single-pole testing is performed. Optionally test with all poles in series for time test and each pole separately for comparison.

c. Test molded-case breakers per Section 3.01.F.1.

d. Perform operational tests by initiating control devices to affect proper operation.

3. Test Values

a. Bolt-torque levels shall be in accordance with Table 4.0.A unless otherwise specified by manufacturer.

b. Insulation-resistance test results shall conform with Table 4.0.B.

c. Control wiring-insulation test voltage shall be 1000V dc. Manufacturer shall be consulted for test voltage where solid-state control devices are utilized.

d. Perform overload tests at three hundred percent (300%) of motor full-load current. Trip times shall be in accordance with manufacturer's tolerances. Investigate values in excess of one hundred twenty (120) seconds.

3.02 SYSTEM FUNCTION TESTS

A. General

1. Perform system function tests upon completion of equipment tests as defined in Section 3.01. It is the purpose of system function tests to prove the proper interaction of all sensing, processing, and action devices.

2. Implementation

a. Develop test parameters for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements.

b. Test all interlock devices.

c. Record the operation of alarms and indicating devices.

Table 4.0
Tables A U.S. Standard

Bolt Torque Values for Bus Connections
Heat-Treated Steel - Cadmium or Zinc-Plated

GRADE	SAE	SAE 1&2	SAE 5	SAE 6	8	
	minimum tensile strength (P.S.I.)	64K	105K	133K	150K	
	bolt diameter (inches)		torque (foot pounds)			
	1/4	4.0	5.6	8.0	8.4	
	5/16	7.2	11.2	15.2	17.6	
	3/8	12.0	20.0	27.2	29.6	
	7/16	19.2	32.0	44.0	48.0	
	1/2	29.6	48.0	68.0		73.6
	9/16	42.4	70.4	96.0	105.6	
	5/8	59.2	96.0	133.6	144.0	
	3/4	96.0	160.0	224.0	236.8	
	7/8	152.0	241.6	352.0	378.4	
	1	225.6	372.8	528.0	571.2	

Bolt Torque Values for Bus Connections
Silicon Bronze Fasteners*

	Torque (Foot Pounds)	
Diameter	Non-Lubricated	Lubricated
5/16	15	10
3/8	20	14
1/2	40	25
5/8	55	40
3/4	70	60

*Bronze alloy bolts shall have a minimum tensile strength of 70,000 pounds per square inch.
Aluminum Alloy Fasteners**

Torque (Foot Pounds)	
Diameter	Lubricated
5/16	8.0

3/8	11.2
1/2	20.0
5/8	32.0
3/4	48.0

**Aluminum alloy bolts shall have a minimum tensile strength of 55,000 pounds per square inch.

Bolt Torque Values for Bus Connections
Stainless Steel Fasteners***

	Torque (Foot Pounds)
Diameter	Uncoated
5/16	14
3/8	25
1/2	45
5/8	60
3/4	90

***bolts, cap screws, nuts, flat washers, locknuts: 18-8 alloy
Belleville washers: 302 alloy

Table B
Insulation-Resistance Test Voltages
for Electrical Apparatus

Maximum Voltage Rating of Equipment	Recommended Minimum Insulation Minimum Test Voltage, dc	Resistance in Megohms
250 Volts	500 Volts	25
600 Volts	1,000 Volts	100

Table C

Insulation-Resistance
Temperature Conversion Factors
For Conversion of Test Temperature to 20°C

Temperature °C	Temperature °F	Multiplier Apparatus Containing Solid Insulations
0	32	0.40
5	41	0.45
10	50	0.50
15	59	0.75
20	68	1.00
25	77	1.30
30	86	1.60
35	95	2.05
40	104	2.50
45	113	3.25
50	122	4.00
55	131	5.20
60	140	6.40
65	149	8.70
70	158	10.00
75	167	13.00
80	176	16.00

END OF SECTION

SECTION 16111
CONDUIT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide conduit including conduit, flexible conduit couplings and connectors, expansion fittings and surface metal and non-metallic raceway systems, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16120 - Wire and Cable
4. Section 16130 - Boxes
5. Section 16140 - Wiring Devices
6. Section 16170 – Grounding
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCES

A. Underwriters' Laboratories, Inc., (UL) Standard and Product Listing.

B. National Electrical Manufacturers' Association (NEMA) Standards.

1.04 SUBMITTALS

A. Product data for material and equipment specified under this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conduit:

1. Minimum size 1".
2. Rigid Schedule 40 PVC with code size ground wires may be used for

underground distribution feeders.

3. Encase PVC and rigid steel raceways with minimum of 3 inches of concrete slurry to exterior of building line.
4. 1/2 lap wrap raceways inside building underslab with "3M" Scotchwrap No. 50 tape or equal Manville Co. No. VID-10 tape; or minimum of 3 inches of concrete encasement.
5. Rigid schedule 40 PVC with code size minimum #12 ground wires may be used for branch circuits in soil or in concrete on grade (one inch maximum), terminate with schedule 80 stub-ups and elbows. Conduit placed on top of aggregate base and embedded into slab, shall not encroach more than 1-1/2" at any location.
6. Rigid threaded, hot dipped galvanized steel for service raceways and conduits in/under concrete floors or walls. All metallic conduits, couplings, and elbows in soil or in contact with soil to be 1/2 lap wrapped with Scotch #50 tape or factory coated with a bonded polyvinylchloride, minimum 20 mil thick, coating.
7. Electrical metallic tubing for interior branch circuit conduit work, above floor slab. Not for any work on building exterior.
8. Intermediate metal conduit (IMC) - threaded hot dipped galvanized for all conduits on building exterior.
9. Flexible metal conduit - minimum 1/2 inch size, steel armor type with code sized minimum #14 bare copper ground wire for interior work, for connection to recessed fixtures.
10. Liquid tight flexible metal conduit - minimum 1/2 inch size, with sunlight resistant PVC jacket over an inner flexible metal core. UL listed for grounding without separate ground wire for connections to motors and equipment, outdoors and in wet locations, with liquid tight connectors.

B. Couplings and Connectors:

1. Threaded for rigid galvanized steel and intermediate metal conduit.
2. Liquid tight compression gland or set screw for EMT.
3. Screw-in type connectors for flexible metal conduit with insulated throat.
4. Compression gland for liquid tight flexible metal conduit suitable for grounding.
5. Connectors to outlets, pull boxes, junction boxes and equipment liquid tight compression gland with insulated throat.

C. Expansion Fittings:

1. For expansion joints 0-inches to 2-inches: O-Z/GEDNEY type "AX" for rigid steel or IMC, type TX for EMT in open areas. Where used in cored openings through structure or in concrete combine AX with DX.
2. For expansion joints larger than 2-inches: OZ/GEDNEY AX8 in open areas. Where used in cored openings through structure or in concrete combine AX8 with DX.
3. In all areas provide bonding jumper listed for use with the expansion fittings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide and place in the concrete forms all conduit, inserts and sleeves in time to prevent any delay in the concrete work.

B. Minimum burial for all conduits exterior to building shall be 36 inches, unless otherwise noted.

C. Size raceways in accordance with Chapter 9 Table 3A of NEC.

D. Install conduit concealed in all areas, excluding equipment rooms, connections to motors, and connections to surface cabinets.

E. For exposed runs, attach surface-mounted conduit with clamps. Route all exposed conduits parallel or perpendicular to building structure.

F. Make connections to motors with sufficient length of flexible conduit to avoid transmission of vibration and permit equipment location adjustment.

G. Coordinate installation of conduit in masonry work.

H. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt or moisture.

I. Clean and swab conduits before installation of conductor.

J. Alter conduit routing to avoid structural obstructions, minimizing crossovers. Conduit placed on top of aggregate base and embedded into slab, shall not encroach more than 1-1/2" at any location.

K. Seal conduits with duct seal in junction/pull boxes where conduits leave heated area and enter unheated area.

L. Provide flashing and pitchpockets making watertight joints where conduits pass through roof or waterproofing membranes.

M. Allow minimum of 6 inches clearance at flues, steam pipes, and heat sources.

N. Fasten conduits securely to boxes with locknuts and bushings to provide good electrical continuity.

O. Provide chrome escutcheon plates at all exposed wall, ceiling and floor conduit penetrations.

P. Provide nylon pull lines in all empty conduits, minimum 100 lbs. tensile strength.

Q. Install surface metal raceway as noted, plumb with all edges aligned and flush. All sections field cut to be burnished to remove all sharp edges.

R. Penetrations:

1. Waterproof through Exterior Walls and floors Below Grade:
   a) Rigid steel as specified.
2. Through Interior Concrete Walls and Floors:
   a) General: Use rigid steel sleeves as specified.
   b) Wall Sleeves: Extend 2" on both sides of wall.
   c) Floor Sleeves: Set flush with bottom of floor, extend 2" above floor.
   d) Sleeves for Future Use: Shall have threaded end with cap above floor and on one side of wall.
3. In Shelter Building:
   a) Through floors, regardless of number of penetrations, provide rigid steel sleeves as specified for interior concrete walls and floors.
   b) Through walls provide slot openings to accommodate number of conduits.
4. Through Interior Fire Rated Dry Walls:
   a) For One or Two Conduits: Use sheet metal sleeves as specified. Extend sleeves minimum 1/4" on both sides of wall.
   b) For More Than Two Conduits: Provide opening in wall, maximum 3/4" larger than needed for conduits.
5. Through Interior Non Fire Rated Dry Walls:
   a) Provide opening in wall, maximum 3/4" larger than needed, for conduit or group of conduits.
   b) Fill openings around and between conduits with plaster.
6. Through Roof:
   a) Wall and Floor Openings: Verify exact locations and sizes prior to installation.

S. Sealing of Sleeves and Openings: Seal as follows:

1. Waterproof Walls and Floors: Provide O-Z/Gedney Type FSK and Type WSK or approved equal.
2. Fire Rated Floors and Walls: Provide approved fire stop system found in the UL Fire Resistance Directory, as manufacturer by Hevi-Duty/Nelson or 3M.

T. Maintain minimum separation 6" to all low voltage conduits, data, communication and signal.

U. All exposed raceways and boxes in occupied areas or on exterior walls shall be epoxy painted to match adjacent finishes (after installation). Install all exposed conduits parallel to building lines and in a neat and professional manner consistent with the adjacent areas.

END OF SECTION

SECTION 16120
WIRE & CABLE

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide wire and cable, including wire, cable, connectors, lugs, splice insulation and terminal blocks, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16130 - Boxes
5. Section 16140 - Wiring Devices
6. Section 16170 – Grounding
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc. (UL) Standards and Product Listing.

B. Insulated Cable Engineers Association (ICEA):

1. "Thermoplastic Insulated Wires and Cable."

C. National Electrical Manufacturers Association (NEMA):

1. WC-5-1973 (R-1979)

D. Institute of Electrical and Electronic Engineers (IEEE).

1.04 SUBMITTALS

A. Product Data for all material and equipment specified under this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Building Wire:

1. American Insulated Wire Co.
2. Essex Group Inc.
3. Houston Wire & Cable Co.
4. South Wire Co.

B. Lugs, Connectors and Terminations:

1. Burndy
2. Thomas and Betts
3. Minnesota Mining and Manufacturing
4. Gedney Co.
5. Terminal Blocks
   a. Buchanan
   b. Connectron
   c. Entrelec

2.02 MATERIALS

A. Building Wiring: 98 percent conductivity copper, 600 volt insulation, type THHN for branch circuits in dry locations, type THWN for wet locations and exterior work, type THHN for feeders. All cables No. 10 and smaller to be solid and all control wiring No. 14 and smaller to be stranded.

B. Branch Circuit Wiring: Conductors smaller than No. 12 AWG gauge not permitted. 20A, 120V branch circuits in excess of 100 feet, No. 10 throughout.

C. Lugs and Connectors for 600 Volt Class Conductors:

1. For cable connections to all equipment, except for connections to molded case circuit breakers. T&B 54100 series one hole for lugs and 54500 series for cable splice connectors.
2. Provide lugs and connectors larger than #2 with T&B "HS" heat shrinkable tubing insulation after assembly.
3. For cable connections #8 to #6 to all equipment, except for connections to molded case circuit breakers Burndy series 'QA-B' for lugs and Burndy series 'QR' with covers for cable splice connectors.
4. Series 'PT' with cover for taps in #6 and larger conductors and T&B series 54600 series for #8 and smaller conductors.
5. Lugs for #14 and smaller conductors Burndy type YAV/YAV-F to suit terminal, applied with proper tool.
6. For splices in #12 and #10 Scotchlock types 'Y' and 'R'.
7. Splices for control wiring to be T&B 'STA-KON' nylon self-insulated butt splices

applied with proper tool.

8. Splice Insulation: Electrical tape with vinyl plastic backing or rubber tape with protective friction tape.
9. Terminal blocks for control connections:
   a. All control connections shall be made to base mounted, 600 volt rated terminal blocks suitable lugs used, Connectron "KU" series with 'NUC' covers or approved equal by Entrelec.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Make conductor length for parallel feeders identical.

B. Lace groups of feeder conductors in pullboxes and wireways.

C. Provide copper grounding conductors and straps.

D. 600V Class Conductors:

1. Use wire-pulling lubricant for pulling No. 4 AWG and larger wire.
2. Install wire in conduit runs after concrete, plastering, and taping work is complete and after moisture and debris is swabbed from conduits.
3. Splice only in accessible junction or outlet boxes. Splices are not permitted in feeders.
4. Color code conductors to designate neutral conductor and phases as follows:

Voltage	Phasing	A	B	C	N	G
120/208	3 Phase 4W	Black	Red	Blue	White	Green

5. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors (or neutrals).
6. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single conduit.
7. Neatly arrange and "marlin" wires in Switchboard, Distribution and other Panels, and Terminal Boxes with T&B "Ty-rap" or approved alternate plastic type strapping.
8. Install feeder cables in one continuous section. Exercise care in pulling, to avoid damage or disarrangement of conductors, using approved grips. No cable shall be bent to a smaller radius than the spool on which it was delivered from the manufacturer. Color code feeder cables at terminals. Provide identifying linen tags in each pull box.
9. Individual control wires shall be the same color throughout from origin to final termination, change of color at splices is prohibited, splices to be minimized.
10. The equipment grounding conductors shall be THW insulated copper, colored green, unless noted as bare.
11. Label each branch circuit wire of each electrical system in each pull box, junction

box, outlet box, terminal cabinet, and panelboard in which it appears with 'EZ' numbering tags. Provide feeders with linen tags, indicating point of origin and equipment served.

12. Provide and install vertical raceway cable supports in all risers not to exceed spacing per Table 300-19(a) N.E.C.

E. Lugs and connectors to be circumferentially crimped to conductors with proper tool and dies, with number of crimps as recommended by manufacturer.

F. All terminal blocks and terminals shall be identified and permanently labeled conforming to Contract and Vendor prepared drawings.

G. Where terminal blocks are installed in pullboxes to facilitate splices and taps, a typewritten listing of the terminals shall be affixed to the pullbox cover interior.

END OF SECTION

SECTION 16130
BOXES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide boxes, including pullboxes, junction boxes, outlet boxes, terminal boxes, exterior in-grade splice and pull boxes, and through floor fittings, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.
1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16140 - Wiring Devices
6. Section 16170 – Grounding
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc. (UL) Standards and Product Listing.

B. National Electrical Manufacturers' Association (NEMA).

1. OS1-73 (R 1978) "Sheet steel outlet boxes, device boxes, covers and box supports, and cast aluminum covers."

1.04 SUBMITTALS

A. Product data for all material and equipment specified under this section.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials:

1. Pullboxes, Junction and Terminal: Metal construction, conforming to National Electrical Code, with screw-on or removable hinged cover.
2. Flush Mounted Pullboxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.
3. Outlet Boxes: 4" square hot dip galvanized, 1.25 oz./sq. ft. or cadmium plated, conforming to UL requirements, ganged as required.
   a. Interior Boxes: Pressed sheet hard drawn steel. Provide attached lugs for mounting where required, or provide with hangers.
   b. Boxes mounted in concrete block, brick or exterior cast walls, Tile Wall type deep boxes.
   c. Exterior Surface Mounted Boxes: Cast, deep FS condulet type with hubs, gasketed cover with spring lid for receptacle covers. Exterior mounted boxes shall be epoxy painted to match adjacent finishes (after installation).
4. Mount Terminal boxes in accessible areas, maximum 72 inches to top. Provide with "Connection" type NT4/MFTA72/MCC or equal terminal strips, number of terminals as noted.
   a. Include on inside cover of terminal cabinets, coordination schedule cross-referencing terminal strip numbering with wiring diagrams.
5. Exterior in-grade splice and pull boxes pre-cast concrete in accordance with utility company specifications. Christy, Jensen Pre-Cast or Forni Corporation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate pullboxes and junction boxes above removable ceilings in area of access panels or in electrical rooms, utility rooms, or storage areas and as noted on drawings.

B. Provide access panels size and type, as directed by Architect where behind finished surfaces.

C. Provide pull boxes, interior and exterior in all conduit runs in excess of 150 feet. Maximum distance between pull boxes not to exceed 250 feet.

D. Adjust position of outlets in finished masonry walls to suit masonry course lines.

E. For boxes mounted in exterior walls provide insulation behind outlet boxes to prevent condensation in boxes.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide wiring devices, including wall switches, receptacles, coverplates, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16170 – Grounding
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc. (UL) Standards and Products Listing.

B. National Electrical Manufacturers Association (NEMA).

1. WD-1 "General-purpose wiring devices."
2. WD-6

1.04 SUBMITTALS

A. Product data for all material and equipment specified under this Section and 16000.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type - Leviton, Decora Plus 15A, 120/277 Volt Switches:

1. Single Pole - White Rocker and Frame - No. 5601 - W

2. Pilot Lights - No. 5640 - 2W

B. Manufacturer and Type - Leviton, Decora Plus 20A, 125 Volt, Receptacles:

1. NEMA 5-20R White duplex - No. 16352-W.
2. NEMA 5-20R White GFCI - No. 6899-W.

C. Cover Plates:

1. Smooth nylon, flush mounting, oversize, color to match device. Manufacturer same as device.
2. Cast Metal (for exterior and wet locations): Die cast profile, ribbed for strength, flash removed, primed with grey enamel, furnished complete with four mounting screws.
3. Gaskets: Resilient rubber or closed cell foam urethane.
4. Steel: Hot dip galvanized surface-mounted in mechanical areas.
5. Surface Box Plates: Bevelled, steel, pressure formed for smooth edge to fit box. Mechanical and electrical equipment rooms only.
6. Weatherproof Plates: Plastic coated cast metal gasketed; provide spring loaded gasketed doors. Exterior and wet locations only.

D. Other Acceptable Manufacturers:

1. Hubbell
2. Pass & Seymour

2.02 MATERIALS

A. Switches, Quiet action, rocker handle, with totally enclosed case, rated 20 ampere, specifications grade. Provide matching 2-pole, 3-way and 4-way switches.

B. Specification grade receptacles full gang size polarized, parallel blade, duplex or single, grounding type, rating as noted.

C. Nameplates: Provide engraved nameplates for devices other than standard duplex receptacles and switches indicating voltage, phase and amperes and circuit number.

D. Color: Provide white devices in areas with light wall finish. Receptacles connected to standby power circuits shall be red with red coverplates.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount switches 42 inches above floor unless otherwise noted.

B. Coordinate switch mounting locations with architectural details.

C. Mount receptacles vertically, square and plumb, above finished floor, with grounding

pole at top, unless noted otherwise on drawings.

D. Mount receptacles above counter above splash horizontally.

E. Corresponding branch panel and circuit shall be engraved on all trim plates.

F. Provide No.12, green, TW conductor from every outlet box to ground screw of every flush receptacle.

G. Install cover plates on all wiring devices and junction boxes.

END OF SECTION

SECTION 16170
GROUNDING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide power system grounding including ground rods, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16190 - Supporting Devices
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Institute of Electrical and Electronic Engineers. (IEEE)

PART 2 - PRODUCTS

A. Rods:
1. As shown on plans.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Connect ground bus in Main Switchboard MS2 system ground wire system which shall be permanently bonded to concrete encased electrode ground system and to ground grid with rods. See plans for detail.

B. When more than one rod is driven, space them apart at least the full length of the rod or two lengths then able.

D. All ground wire connections shall be exothermic, "thermite" or "cadweld", welded.

E. Terminate grounding conduits at equipment with ground bushing; with ground wire connected through bushing.

F. Provide No. 12 (green) TW conductor from outlet box to ground screw of every receptacle.

G. Ground all isolated sections of metallic raceways.

H. Ground wires shall be bare copper cables in conduits with conduits bonded to ground cables.

K. Bond all metallic piping systems as per NEC Article 250-80.

L. Grounding system for Building B shall be as shown on plans.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide all supporting devices as required for this work including conduit supports, meter/main anchoring, equipment anchoring, noise and vibration control, complete, as specified by Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16400 – Service and Distribution
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 VIBRATION ISOLATION GENERAL REQUIREMENTS

A. Submit shop drawings in accordance with Section 16000 and as noted herein. The submittal shall contain the following information:

1. Catalog cuts and data sheets on specific vibration isolators to be utilized, showing compliance with the specification.
2. An itemized list showing the items of equipment, to be isolated, the isolator type and model number selected, isolator loading and deflection.

B. Coordination: The Contractor shall coordinate his work with other trades to avoid rigid contact between isolated transformers and panel with the building. He shall inform other trades following his work to avoid any contact which would reduce the vibration isolation.

C. Conflicts and Discrepancies:
   1. The Contractor shall bring to the Owner's attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein, due to inadequate space, etc. Corrective work necessitated by conflicts after installation shall be at the responsible Contractor's expense.
   2. The Contractor shall bring to the construction manager's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation. Corrective work necessitated by discrepancies after installation shall be at the Contractor's expense.

D. Seismic Restraint Requirements:

   1. Seismic restraint shall be furnished and installed in accordance with all relevant State and Local code requirements.

F. Responsibility of Manufacturer:

   1. Vibration isolation manufacturer shall have the following responsibilities:
      a. Determine vibration isolation sizes and locations.
      b. Provide equipment isolation system as scheduled or specified.
      c. Guarantee specified isolation system deflection.
      d. Provide installation instructions and drawings.
      e. Provide calculations by a licensed civil engineer certifying that the seismic restraints will act in accordance with the relevant state and local codes and will maintain equipment in captive position.
      f. Provide approved resilient restraining devices as required.
      g. Provide signature of a licensed engineer for all calculations on the seismic snubbers.

PART 2 - PRODUCTS

2.01 ANCHOR METHODS

A. Solid Masonry: Lead expansion anchors or preset inserts.

B. Concrete Surfaces: Self-drilling anchors or powder-driven studs.

2.03 VIBRATION ISOLATORS

A. General Properties:

   1. All vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.
3. The ration of lateral to vertical stiffness shall not be less than 1.0 or greater than 2.0.
4. The vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than + or - 10%.
5. Wave motion through the isolator shall be reduced to the following extent: Isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system, with a minimum isolation of 50 decibels above 150 cycles per second.
6. All neoprene mountings shall have a shore hardness of 50 to 60 after minimum aging of 20 days or corresponding oven aging.
7. All vibration isolation equipment exposed to moisture or an outdoor environment shall be coated as follows:
   a. All steel parts to be hot-dipped galvanized.
   b. All bolts to be cadmium plated.
   c. All springs to be cadmium plated and neoprene coated.

B. Isolator Types and Descriptions:

1. Type WMN - All direction mount with a captive neoprene element and steel insert. Capable of use in compression, tension and shear. Equal to Mason Industries Type RBA and RCA or approved equal.
2. Type HMN - Neoprene mount having seismic restraint. Maximum static deflection of 0.3 inch. Equal to Mason Industries "Seismic Neoprene Mount" or approved equal.
3. Type SSLFH - Captive spring mount. Equal to Mason Industries "SSLFH" or approved equal.
4. Type SER - Captive spring mount. Equal to Mason Industries.

PART 3 EXECUTION

3.01 INSTALLATION OF SUPPORTS

A. Design all electrical equipment, raceways and anchorages to resist earthquake loads required by the California Building Code - Seismic Zone 4.

3.02 INSTALLATION OF VIBRATION ISOLATION DEVICES

A. General:

1. Transmission of perceptible, vibration, structure borne noise to occupied areas by equipment installed under this contract will not be permitted.
2. Install vibration isolators per manufacturer's directions.

3.03 VIBRATION ISOLATION REQUIREMENTS

A. 240V Distribution Panels:

1. Wall mounted connected to adjacent transformers within buildings by flexible conduit.
2. Type WMN, 0.1 inch static deflection.
3. Locate at four corners.

END OF SECTION

SECTION 16400
SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide all service equipment including main service switchboard/distribution and feeder, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16190 - Supporting Devices
9. Section 16424 - Motor Connections and Controls
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc. (UL) Standards and Products Listing

B. National Electrical Manufacturers' Association (NEMA):

1.04 SUBMITTALS

A. Submit Shop Drawings and Product Data for all equipment specified in this section in accordance with 16000.

1. Shop drawing showing switches, breakers, wiring, fuse sizes, interconnection diagram, cabinet arrangement and sizes.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers: Match Existing Switchboard or Cutler-Hammer, General Electric Company, Square "D" Co., or Siemens.

B. All equipment specified herein to be product of one manufacturer.

2.02 MAIN SWITCHBOARD (Existing)

2.03 PANELBOARDS AND DISTRIBUTION BOARDS

A. General:

1. Furnish and install at locations as shown on the drawings approved panelboards flush or surface mounted of a type indicated and specified herein.

B. Interiors:

1. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining drilling or tapping.

2. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. A nameplate shall be provided listing panel type and ratings.
3. Unless otherwise noted, double size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing circuit requiring a neutral connection. A full size ground bus will be included in all panels.

C. Boxes:

1. Boxes shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with National Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, riser panels the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.

C. Trim:

1. Switching device handles shall be accessible. Doors and panelboard trims shall not uncover any live parts. Doors shall have flush type cylinder lock and catch except doors over 48 inches in height shall have auxiliary fasteners top and

bottom of door in addition to the flush type cylinder lock and catch. Panelboard switching devices with individual dead front doors shall be acceptable in lieu of standard door in trim design. Panelboard trim clamps shall be of the indicating type. Bottom of all trims to have lugs for resting on cabinet flange.

2. Door hinges shall be concealed. All locks shall be keyed alike; furnish two keys for each panel; directory frame and card having a transparent cover shall be furnished with each door.

3. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim clamps shall not be accessible when the panel door is closed and locked.

4. Panelboard fronts shall be door-in-door construction.

E. Conductors (Main Bus and Branch Connectors):

1. All main bus bars shall be copper sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50°C above an ambient of 40°C maximum.

F. Circuit Breaker Distribution Panels:

1. These panels shall be provided with bolt-on molded case circuit breakers tested and UL labeled per UL 489.

2. Breakers 100 ampere through 400 ampere frame sizes shall be thermal-magnetic trip with inverse time current characteristics, unless otherwise noted.

3. Breakers 600 ampere frame and above shall have solid-state trip and rating plugs with trip ratings as indicated on drawings. Rating plugs shall be interlocked so they cannot be inter- changeable between frames and interlocked such that the breaker cannot be latched with rating plug removed. Breakers shall have built-in test points for testing all breakers 600 ampere and above. Trip unit shall have adjustable short time delay and adjustable instantaneous pickup. Breakers shall be Westinghouse Seltronic or approved equal.

4. Molded case breakers shall have a minimum 18,000 symmetrical RMS interrupting capacity at 240 volts. Unless otherwise noted on single line diagram.

G. Lighting and Receptacle Panels:

1. Panels for use at 240 volts AC maximum shall incorporate bolt-on circuit breakers as shown rated at 10K A.I.C. symmetrical at 240 volts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide mounting brackets, busbar drillings, and filler pieces for unused spaces.

B. Each branch circuit of lighting and power branch circuit panels to have a permanently fixed number with one word directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of outlets controlled by breakers.

C. Color code mains and each breaker load side terminal, same as conductor insulation.

D. All lugs per Section 16120, Wire and Cables.

E. Align breakers on same phase horizontally. Provide common simultaneous trip for 2 and 3-pole breakers with one handle. Provide each panel with five handle locks.

F. Connections of busses and circuit breakers made with machine screws.

G. Provide locking devices for circuit breakers controlling electric discharge lighting circuits in accordance with local regulations.

H. Provide handle ties for breakers controlling multi-wire branch circuits in accordance with local Electrical Safety Orders. Install handle ties so that the individual breakers can 'trip free' without affecting other poles on common handle tie.

I. Structures, doors and trims primed and painted with one coat of factory standard color.

J. Properly identify all panelboards, switchboards, and other equipment provided under this section by means of black with white engraved laminated plastic descriptive nameplates 1/4 inch high lettering for panel designation and 1/8 inch high lettering for panel voltage. Mount nameplates using poprivets or screws, clamp holders in any form are not acceptable.

K. Distribution panelboards: Prepare and affix bakelite engraved phenolic nameplates to each breaker indicating loads controlled.

END OF SECTION

SECTION 16424
MOTOR CONNECTIONS AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide motor connections and controls, complete, as shown and specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 - Electrical Acceptance Testing
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16190 - Supporting Devices
9. Section 16400 – Service and Distribution
10. Section 16495 - Requirements For Other Equipment
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

B. Control Devices: Including low voltage and 120V control wiring and conduit; provided under Division 15, unless otherwise specified or shown.

C. Motors: Furnished under other applicable Sections, unless otherwise shown; installed and connected under this Section.

D. Starters and Disconnect Switches: Those furnished under other applicable Sections; installed and connected under this Section.

E. Refer to Mechanical control diagrams for coordination.

1.03 QUALITY ASSURANCE

A. Manufacturers: Same as selected for switchboards and panelboards.

1.04 SUBMITTALS

A. Shop Drawings: Include layout of starter units, and integral control wiring diagrams. Submit shop drawings in accordance with Section 01330 and 16000.

B. Product Data: Manufacturer's specifications and data.

C. Seismic Restraints: Design calculations as specified.

1.05 PRODUCT HANDLING

A. Delivery: Receive and store motors, and starters and disconnect switches furnished under other applicable Sections.

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES

A. Heavy duty, horsepower rated.

B. Quick make, quick break.

C. Visible blade.

D. Provision for padlocking.

E. Dual cover interlock with switch handle.

F. Enclosures NEMA type, consistent with environment.

2.02 STARTERS

A. Manual Starters:

1. Molded plastic switch.
2. Overload trip resetable assembly; one in each phase.
3. Enclosures NEMA type; consistent with environment.

B. Combination Magnetic Motor Starters:

1. Combination fusible disconnect switch, magnetic motor starter.
2. 120 volt control circuit with fuse protection and control transformer.
3. Green neon indicating light.
4. Two normally open and one normally closed spare auxiliary contact in addition to those used.
5. Dual cover interlock with switch handle.
6. Thermal overload relays; one in each phase.
7. Enclosure NEMA type consistent with environment.
8. Identification nameplates; pop-rivet or screw fastened.
9. HAND-OFF AUTO switch, unless otherwise shown.
10. Provisions for padlocking.

2.03 EQUIPMENT FURNISHED BY OTHER DIVISIONS

A. Where equipment is to be provided by other divisions and requires electrical supply and/or connections, the contractor shall coordinate and determine the electrical equipment and material necessary for this division to provide and to install the complete system. The division furnishing the equipment shall erect, level, align and prepare the equipment for Division 16 work, along with providing the installation instructions, and the diagram for the electrical work. Division 16 shall provide the electrical rough-ins, electrical accessories not furnished by the other Division and the final connections for a complete and operating installation. Division 16 shall provide start up and testing assistance as agreed between the Divisions.

2.04 ELECTRICAL EQUIPMENT INSTALLATION

A. Electrical equipment associated with equipment provided under other divisions shall be furnished, installed, and wired in accordance with the following installation schedule. Deviations and clarifications of this schedule are permitted only with the written consent of the City.

B. Required power wiring and conduit shall be provided under Division 16 for all equipment and device.

C. Installation Schedule

		Furnish Equip. Device	Install Equip. Device	Provide Control Wire and Conduit
1.	Temperature control devices and panels	Division 15	Division 15	Division 15
2.	Electrical thermostats furnished as part of the equipment	Division 15	Division 15	Division 15
3.	Line voltage control thermostats furnished as part of the equipment	Division 15	Division 15	Division 15
4.	Control valves, automatic dampers, damper operators, solenoid valves, insertion temperature and pressure sensors	Division 15	Division 15	Division 15
5.	Airflow control devices	Division 15	Division 15	Division 15

6.	Air supply equipment	Division 15	Division 15	Division 15
7.	Switch and pilot light stations	Division 16	Division 16	Division 16
8.	Control power transformers	Division 15	Division 15	Division 15
10.	Duct Smoke Detectors	Division 16	Division 15	Division 16/15
11.	Smoke detectors, and alarms including relay for fan shutdown	Division 16	Division 16	Division 16/15
12.	Motors	Division 15	Division 15	Division 15
13.	Motors starters not furnished with mechanical equipment	Division 16	Division 16	Division 15
14.	Motor starters furnished loose with mechanical equipment	Division 15	Division 16	Division 15
15.	Disconnect switches, and thermal overload switches	Division 16	Division 16	Division 15
16.	Sprinkler system water flow and tamper switches	Division 15	Division 15	Division 16
17.	Mechanical piping heat tracing (including relays, contactors, thermostats, etc.)	Division 15	Division 16	Division 15
21.	Interlock wiring for mechanical equipment if indicated on electrical drawings	Division 16	Division 16	Division 16

PART 3 EXECUTION

3.01 GENERAL

A. Clearances: Provide code-required clearances and access for electrical devices, or as otherwise required by the Contract Documents.

B. Motor Connections: Make final connections to motors with liquid-tight flexible conduit and fittings as specified. Provide ground wire in flexible conduits and sized per code. Length and bend as specified under flexible liquid tight conduit installation methods.

C. Control Connections: Coordinate with work done under other trades to allow for proper connection and operation of each piece of equipment.

D. Starters: Check overload relay heaters with motor nameplate full load current. Change heaters per manufacturer's recommendation if not correctly rated at no additional cost.

E. Clean equipment before putting into operation.

3.02 TESTING

A. Motors and Starters: After connections are made, motors, and driven equipment are properly lubricated and preparations for operation, including that of other trades are completed, test motors for proper rotation and satisfactory operation.

B. Check overload elements in motor starters for suitability to motor ratings and operation characteristics.

C. Replace overload elements not properly sized.

D. Investigate and correct cause of motors operating above full load rating instead of increasing overload relay trip setting.

3.03 IDENTIFICATION

A. Provide nameplates as specified for individually mounted starters, relays, controllers, and control devices.

END OF SECTION

SECTION 16495
REQUIREMENTS FOR OTHER EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide electrical connections meeting the requirements for other equipment, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 - Electrical Acceptance Testing
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16190 - Supporting Devices
9. Section 16400 – Service and Distribution
10. Section 16424 - Motor Connections and Controls
11. Section 16510 - Interior Building Lighting
12. Section 16720 – Fire Detection and Alarm Systems

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MISCELLANEOUS SYSTEMS

A. Provide power as required for the following Systems:

1. Fire Alarm System
2. Voice and Data Communication Systems (by others)
4. Security and Access Systems (by others)

3.04 Plywood Backboards: Where shown on plans: Provided under Section ROUGH CARPENTRY.

3.05 - Grounding: Provide ground wire in 1"conduit as required for telephone/data equipments.

3.06 Fish Wire: Provide all empty conduits in excess of 15' length with nylon cord fish wire, tensile strength of 100 lbs. minimum.

END OF SECTION

SECTION 16510
INTERIOR BUILDING LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. General: Provide interior building lighting including luminaries, lamps, ballast, supports and accessories including plaster frames, trim rings and backboxes for plaster or drywall ceilings or concrete, complete, as specified per Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following work is included in other Sections. Where coordination is necessary, it shall be provided by this Contractor.

1. Section 16000 - Electrical - General Requirements
2. Section 16011 – Electrical Acceptance Test
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16190 - Supporting Devices
9. Section 16400 – Service and Distribution
10. Section 16424 - Motor Connections and Controls
11. Section 16495 - Requirements For Other Equipment
12. Section 16720 – Fire Detection and Alarm Systems

1.03 REFERENCE STANDARDS

A. Illuminating Engineering Society of North America (IES).

1.04 SUBMITTALS

A. Submit Shop Drawings and Product Data for all equipment and material specified in this Section in accordance with Sections 01330 and 16000.

B. Submit shop drawings for luminaries indicating pertinent physical characteristics.

C. Prior to shop drawing submittals, verify type of ceiling construction with type fixtures for proper fit of fixtures to be installed. Submit cross-referenced schedule with fixture brochure, denoting the number of each room, its ceiling construction and type fixture mounting for fixture(s) to be installed in room.

D. Where a specific finish or color is not specified and options exist, submit color and/or finish samples to Architect for selection. Fixtures not having color and/or finish acceptable to Architect shall be replaced at no additional cost.

1.05 COORDINATION

A. Coordinate installation of plaster frames, trim rings, and backboxes with other trades involved in ceiling.

B. Coordinate with Divisions 15 to avoid conflicts between luminaries, supports, fittings, and mechanical equipment.

PART 2 - PRODUCTS

2.01 LUMINARIES

A. Types and manufacturers as noted on luminaire schedule.

B. Substitutions, in accordance with Section 16000, to the base bid specification to be reviewed the following samples and technical information must be supplied:

1. A working sample of the alternative luminary complete with lamp, ballast and optical system that will be supplied for the bid installation. For convenience, the Architect may require a sample that operates at 120 volts.
2. A complete photometric report of the submitted sample with the specified lamp type and wattage including tabulated candlepower, coefficient of utilization, and iso-foot candle diagram. Prorated data will not be acceptable. The photometric report must be done in accordance with published IES testing procedures and certified by a registered electrical engineer. Data may also be supplied in the form of a data file on 3 1/2" floppy disk or CD in IES format for use in a recognized computer lighting program.
3. A current original catalog data sheet with luminary catalog number. Modified data sheets will not be acceptable.
4. A point by point computer printout verifying the illumination criteria for the entire site plan based on using the alternative luminaries. The spacing increment of points on the verification printout shall not exceed ten feet in either direction. The printout shall be based on maintained foot candle levels based on the criteria set by the engineer for this specific project with a summary table showing the maximum, minimum, and average horizontal foot candle levels on the entire area.

2.02 LAMPS

A. Acceptable Manufacturers:

1. Manufacturer and Type: General Electric Company.
2. Other Acceptable Manufacturers:
   a. Phillips.
   b. Sylvania/Osram.

B. Fluorescent Lamps:

1. Super T8, color temperature of 3500K and 85CRI, 3100 initial lumens 24,000 hour rated lamp life.
2. Compact fluorescent lamps 3000K color temperature and 85 CRI.
3. T5 lamps shall have minimum rated lamp life of 20,000 hours for 18 and 40 watt lamps and 12,000 hours for 27 and 50 watt lamps.
4. T4 lamps shall have minimum rated lamp life of 10,000 hours.

C. Install lamps in accordance with manufacturer's instructions.

D. All lamps to be properly operating at time of final acceptance.

2.03 BALLAST

A. Fluorescent Ballasts: Ballast shall be Advance High Frequency electronic or Universal electronic ballast, of US manufacture and carry a five (5) year warranty with up to $15.00 labor replacement allowance.
B. All fluorescent ballasts shall be "A" sound rated, multi-tap 120/277 V inputs, THD of less than 20%, minimum ballast facto of 0.9 and maximum crest factor of 1.7.
C. The combined use of high output long life T8 lamps and programmed start, reduced ballast factor, electronic ballasts, is intended to provide reduced overall energy usage with equal light (lumen) output to standard lamp/ballast combinations.
D. For room or areas subject to frequent ON/OFF control of lighting (i.e. occupancy sensor controls), fluorescent ballasts shall be extra high efficiency, fully electronic, programmed start, parallel wired, with reduced output ballast factor (max 0.75bf).
E. For rooms or areas where lighting is turned ON/OFF less than four times per day and burns for at least three hours per start, provide extra high efficiency Instant Start, fully electronic, parallel wired ballasts and compatible lamps for increased energy efficiency.

F. Other Acceptable Manufacturers:

1. Advance Transformer Company.
2. OSRAM

G. All ballasts of each type shall be of one manufacturer.

PART 3 - EXECUTION

3.01 SUPPORTS

A. Refer to Section 16190.

3.02 RECESSED LUMINARIES

A. Install recessed luminaries to permit removal from below, to gain access to outlet or prewired flexible box.

B. Connect recessed luminary to boxes with flexible conduit and fixture wire.

C. All materials used in ceilings for supporting of fixtures to be non-combustible.

3.03 INSTALLATION

A. As listed in fixture schedule and on plans; completely lamped with new lamps, properly operating at time of final acceptance of electrical work. Align luminaries.

B. Install surface mounted lighting fixture in accordance with Article 410-76 of N.E.C. and recessed fixtures in accordance with Article 410-16 of N.E.C.

C. Lighting fixtures shall be securely supported, the mounting height of all fixtures in any one room a uniform distance from floor, whether or not outlets or ceiling area over fixtures are level except otherwise noted. Hang surface mounted fluorescent fixtures from outlet boxes in furred ceilings. Boxes supported by bar hangers fastened to furring channels; the fixtures provided with additional supports from above.

END OF SECTION

SECTION 16720
FIRE ALARM SYSTEM

PART 1 – GENERAL

1.01 CONDITIONS AND REQUIREMENTS:

A. Refer to the General Conditions, Supplementary General Conditions and Division 1 – General Requirements.

1.02 INCORPORATED DOCUMENTS:

A. Section 01330 Submittal Procedure, Section 0170 Execution Requirements, applies to all work in this section.

B. Related work included in other sections:

1. Section 16000 - Electrical - General Requirements
2. Section 16011 - Electrical Acceptance Testing
3. Section 16111 - Conduit
4. Section 16120 - Wire and Cable
5. Section 16130 - Boxes
6. Section 16140 - Wiring Devices
7. Section 16170 – Grounding
8. Section 16190 - Supporting Devices
9. Section 16400 – Service and Distribution
10. Section 16424 - Motor Connections and Controls
11. Section 16495 - Requirements For Other Equipment

1.03 DESCRIPTION

A. This specifications intends to describe a fire alarm system which is intelligent analog detecting, low voltage and modular with multiplex communication techniques in full compliance with all applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor.

1. The system shall include all required hardware, conduits, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether itemized or not.

2. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years. The manufacturer shall have an installed base of analog systems as a reference.

3. The new equipment specified is that of the Simplex 4100U system which was selected to meet the special requirements for design of this project.

4. Modification includes, but not limited to, any components replacement, additional or deletion in the control and remote annunciation panel; addition or deletion of external alarm initiating devices, evacuation signal devices; external and internal wiring of the existing control panel; testing of all new devices and equipment , programming of the system; power booster panel and analog interfacing modules.

1.04 MATERIALS AND SERVICES

A. The system shall include the below listed component and material, but not be limited to the following elements:

1. Master system CPU including all fire detection modules.

2. Power supplies, batteries and battery chargers.

3. Equipment enclosures.

4. Intelligent addressable manual pull stations, heat detectors, smoke detectors, strobes, horn-strobe combination, horns, alarm monitoring modules, and supervised control modules;

5. Multiplex driven remote LCD Annunciator panels.

6. Software and devices as required to provide a complete functioning system.

7. Wiring, raceway, and all necessary cutting and patching.

8. Installation, testing, certification, and operator's training.

9. Field verifying field existing conditions before doing any work.

10. Labeling each device with its specific device address with transparent labels and red markings.

11. Test the complete work. Correct any deficiencies to the satisfaction of the City of Livemore and State Fire Marshall.

1.05 APPLICABLE STANDARDS:

A. The publications listed below forms a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. Factory Mutual (FM)

2. National Fire Protection Association (NFPA)

   a. NFPA 13 Standard for the Installation of Sprinkler Systems.

   b. NFPA 13A Recommended Practice For the Inspection, Testing and Maintenance of Sprinkler Systems.

   c. NFPA 70 National Electrical Code.

   d. NFPA 72 Standard for The Installation, Maintenance And Use of Protective Signaling Systems.

   e. NFPA 90A Standard For The Installation of Air Conditioning And Ventilating Systems

   f. NFPA 101 Life Safety Code.

3. Underwriters' Laboratories, Inc. (UL)

4. State and Local Building Codes as adopted By the Division of the State Architect.

5. Dept. of Justice rules for Building Accessibility by The Handicapped.

6. Installation shall be in accordance with the California Administrative Code, Title 24,

1.06 QUALIFICATIONS OF THE INSTALLER:

Before commencing work, submit data showing that the contractor has successfully installed fire alarm systems of the same type and design as specified, or that they have a firm contractual agreement with a subcontractor having the required manufacturers' training and experience. The contractor shall include the names and locations of at least two installations where the contractor, or the subcontractor above, has installed such systems.

1.07 MANUFACTURER'S REPRESENTATIVE:

Provide the services of representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system provided. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation, maintenance and programming.

1.08 SUBMITTAL:

A. The contractor shall include the following information in the equipment submittal for the Architect or Electrical Engineer:

1 Scope of project, as they relate to the fire alarm system.

2 Floor Plans Showing Fire Alarm Devices: An AutoCAD file of the Floor plans shall be provided by the Architect to the contractor. Floor plans shall indicate room identifications, the location of fire and smoke barrier walls for verification of smoke and fire smoke damper, and fire door detection and control.

3 Design and provide scaled Fire Alarm site plans showing all building devices remote annunciation panel and command center, control panel, off-building remote devices, Building Central Terminal Cabinets, conduit sizes, number of conductor and AWG sizes between them.

4 Provide a single line riser diagram to demonstrate:

a. The type of devices installed.

b. The number of devices supplied by each circuit.

c. The subdivision of zones or floors within the building.

5. Provide point-to-point diagram illustrating the wiring methods and styles used for:

a. Initiating circuits.

b. Indicating Circuits.

6. Valid and Current CSFM Listing Sheets shall be provided for every new fire alarm component to be installed within the scope of work of the project. Non-CSFM listed devices permitted to be installed shall include diagrammatic electrical drawings demonstrating their electrical isolation as prescribed in Section 208©, Article 3, Chapter 1.5. Title 19, CCR. Listing numbers noted on the device symbol legend does not meet requirement for listing verifications.

7. Power Calculations

   a. Battery capacity calculations.

   b. Supervisory power requirements for all equipment.

   c. Alarm power requirements for all equipment.

   d. Justification showing power requirements of the system power supplies.

   e. Voltage drop calculation, for wiring and in worst case condition.

8. Provide complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.

9. Floor plans showing all initiating, end of line, supervisory, indicating appliances and output control devices; including circuit interface panels, annunciators, printers, video display terminals, and the main CPU locations.

10. Riser shall show all Fire Alarm Control Panels installed on site and shall also be indicated on the Fire Alarm Site Drawings.

11. A symbol legend reflecting all new fire alarm system devices shall be included. This legend should be consistent with the bid document legend for device identification.

12. Elevation details for manual pull stations and visual fire warning devices. These details include the correct mounting heights in accordance to Chapter 60 of the California Building Code.

13. Design number and detail of through-fire stop systems that are to be utilized for penetrations through fire rated assemblies.

14. Sequence of Operations for the fire alarm system and its interrelated and connected system.

15. Remote annunciation panel dimension, terminals, elevation showing component identification and other pertinent information.

16. Other information as required by the local fire Marshall during application of permit by the Contractor.

   B. For use in system test, a complete operation and maintenance manual with two sets of proposed installation drawings shall be submitted.

      1. The following information shall be inscribed on the cover:

         a. "OPERATION AND MAINTENANCE MANUAL"

b. Site Name and Building location.
c. The name of the contractor, system manufacturer and system subcontractor.
d. The name and phone number of the fire department required to respond to alarms at the project location.

2. The manual shall be legible and easily read with large drawings folded and contained in pockets. Included in the manual shall be circuit drawings, wiring and control diagrams with data to explain detailed operation and control of each item of equipment and a control sequence describing start up instructions. Included shall be installation instructions, maintenance instructions, safety precautions, test procedures, performance data, and software documentation.

C. Upon completion of the installation, record drawings shall be submitted on each system before final acceptance of the work. The contractor shall furnish to the Engineer a set of record drawings including system diagrams for each system. The record drawings masters shall be on high density floppy disks in an AutoCAD Ver. 2000 format.

1.09 SYSTEM FUNCTION:

A. The system shall be a complete, electrically supervised multiplex style fire detection system with intelligent analog alarm initiation, to be device addressable and annunciated as described and shown on the drawings.

1. The maximum number of devices on a single signaling circuit shall not exceed sixty with a capacity of sixty reporting system inputs and sixty system control outputs. The maximum usage of loop addresses shall not exceed 85% of loop capacity.

a. Devices attached to the signaling circuit shall be individually identifiable at the control panel for alarm and trouble indication. Smoke detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the requirement for cleaning, and tested by a single technician using the panel field test routine.
b. Sensitivity settings of individual detectors shall be automatically or manually adjustable from the control panel to reduce the incidence of false alarms caused by environmental conditions.
c. The analog signaling circuits shall be installed in the fire alarm control panel enclosure or in remote circuit interface panel enclosures.
d. Analog signaling circuits shall be selectable Style "Y" or Style "Z" wiring.

2. The system shall support intelligent analog smoke detection, conventional smoke detection, manual station, water flow, supervisory, security, Strobes, horn-strobes, horns and status monitoring devices.

3. The panel shall be UL listed as a test instrument for the measurement of the sensitivity or connected intelligent analog ionization and photoelectric smoke detectors to comply with the testing requirements of NFPA 72 E.

4. The system shall annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarms.

5. Any intelligent analog smoke detector or conventional smoke detector zone shall include a selectable alarm verification capability. This feature shall provide automatic verification of smoke detector alarms as described by NFPA 72.

6. All external circuits shall be listed as power limited circuits per article 760 of the National Electric Code.

7. The system shall provide a one person field test of either the complete system or a specified area, maintaining full functions of areas not under test.

8. The system shall be programmed in the field via a laptop computer. All programmed information shall be stored in nonvolatile memory after downloading into the Fire Alarm Control Panel.

    a. During program upload or download the system shall retain the capability for alarm reporting.
    b. The system shall download to a PC for program editing. System program shall be stored on a floppy disk and all programming shall be multi-level password protected.

9. The system shall consist of a central architecture using a single centrally located control unit. The system also shall be operable in a distributed multiplex architecture using a centrally located control unit with interconnection to remote circuit interface panels containing any combination of plug in intelligent analog signaling circuits, plug in conventional initiating device circuits and plug in relays.

10. The systems as installed shall be Simplex 4100U, expandable to its predetermined maximum capacity of 2000 devices.

1.10 SYSTEM ZONING:

A. Each intelligent addressable device or conventional zone of the system shall be displayed at the fire alarm control panel and remote annunciation panel by a unique alpha numeric label identifying its location.

1.11 SYSTEM DESCRIPTION AND OPERATION:

A. Provide an addressable system that utilizes smoke detectors, heat detectors, water flow indicators, valve supervisory devices, Horns, horn-strobes, horns and controls as shown on the Drawings, a Simplex addressable 4100U system:

1. Power systems and components form DC power supplies.

2. Provide CLASS B system wiring.

B. Trouble and alarm systems shall activate the control panel devices, and remote annunciators.

C. Provide wall-mounted annunciators for any concealed smoke detectors.

1. The smoke detectors shall be individually annunciated.

2. Locate the annunciators in public areas, close to the devices, and in accordance with present life safety codes.

D. Electrically supervises alarm and initiating circuits for wiring or ground faults.

1. Any fault shall cause an audible and visual trouble indication at the control panel and the remote annunciation panel.

2. The zone or addressable device having trouble shall be identified.

3. Zone or addressable device trouble shall not affect normal operation of other system zones.

E. Provide 20% expansion space for future system upgrades.

F. Activation of any alarm initiating device shall:

1. Cause all audible alarm devices to pulse in march time until silenced at the control panel or at the remote annunciation panel;

2. Cause all alarm lamps to flash;

3. Indicate the zone or addressable device at the control panel and at the remote annunciation panel;

G. Activation of any smoke detector device shall;

1. Perform all functions of initiating devices as noted in 1.12-F and notify Fire Department.

2. Light the LED lamp on an operated smoke detectors.

3. Furnish an alarm system closure for connection to an off-site reporting device for monitoring by and call Fire Department.

H. Operation of any sprinkler water flow switch shall:

1. Perform all functions of initiated devices as noted in 1.12-F and notify fire department;

I. Operation of any sprinkler valve supervisory device such as tamper switchers and OS & Y valves shall:

1. Activate a dedicated supervisory zone at the control panel and annunciation at the remote annunciation panel.

2. Not cause evacuation alarm devices to sound.

3. Water flow alarm circuit trouble use for valve supervision is not permitted.

J. Provide audible and visual trouble indication at the control panel and the remote annunciation panel for the following conditions:

1. Removal of a detection device from the detection circuit;

2. An open or ground fault in a detector circuit or device;

3. An open, short or ground fault in an audible signal circuits;

4. Removal of a system input, output or control module;

5. Improper condition of a battery or charger.

K. Failure of AC power shall:

1. Cause the trouble signal to sound at the control panel and annunciation at the remote annunciation panel;

2. Cause the automatic transfer to stand-by battery power.

3. All system functions shall be operational, on battery power, for a minimum of 24 hours during a power failure.

L. System zone assignments shall be per drawings.

M. Fire Drill: Provide fire drill switch at the fire alarm control panel. When activated, the fire drill switch shall turn on all horns and strobes and other alarm notification devices, but it shall not call fire department.

PART 2 – PRODUCTS

2.01 FIRE ALARM CONTROL PANELS:

A. The existing addressable fire alarm control panel is manufactured by Simplex #4100U Fire Alarm Control Panel.

2.02 FIRE ALARM SYSTEM POWER SUPPLIES:

A. System primary power

1. Primary power for the FACP and the secondary power battery chargers shall each is obtained from the power panel board. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm.

2. The power supply and battery charging shall be provided by the power supply interface board and power supply module.

3. A fusible double throw AC power disconnect switch, lockable in the open and closed positions shall be provided adjacent to the Fire Alarm Control Panel.

B. Secondary power supply

1. Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system circuit interface panel. The battery supply shall be calculated to operate its load in a supervisory mode for 60 hours with no primary power applied and, after that time, operate its alarm mode for five minutes.

2. Provide battery charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amps.

2.03 INTELLIGENT DEVICE PROGRAMMER/TESTER:

Furnish as a part of the installed system, a Simplex listed programmer and tester.

2.04 SMOKE DETECTORS, PHOTO ELECTRIC:

Furnish and install Simplex, Photoelectric True Alarm Smoke Sensors, with Simplex True Alarm Detector Bases.

2.05 HEAT DETECTORS, INTELLIGENT RATE COMPENSATED:

Furnish and install Simplex, True Alarm Heat Sensors, with Simplex True Alarm Detector Bases.

2.06 ADDRESSABLE MODULE
Furnish and install Simplex Individual Addressable Module(s)

2.07 MANUAL STATIONS:

Provide and install Simplex Addressable Manual Pull Stations Single Action, with Simplex Individual Addressable Modules and Simplex Back Box for Pull Stations. . All except the Master pull stations shall be provided with an additional cover box. Manufactured by Signal Communications Corp. Front Cover Model NO.ST-FRCO1, Extender Model NO. ST KTRO1 with Alarm Module NO. ALMO1 or approved equal.

2.08 INTELLIGENT SUPERVISED INTERFACE MODULE:

Furnish and install for the control of supervised relays, contractors, audible signal circuits, visual signal circuits, Simplex individual module for, intelligent supervisory and control.

A. A single circuit intelligent signaling circuit interface module for monitoring alarm, trouble, supervisory security or status contact type devices.

2.09 DOOR HOLDERS:

Door Holders shall be LCN model No. 7850.

2.10 TAMPER SWITCH:

Tamper switch with Individual Addressable Module.

2.11. FLOW SWITCH:

Flow switch with Individual Addressable Module.

2.12 System software programming shall be performed by Simplex/Grinnell. Other vendor programming of system software is not permitted.

2.13 Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor, subject to the approval of the Architect or Electrical Engineer.

2.14 EVACUATION SIGNAL:

A. Furnish and install where show on the drawings, audible and /or visual signals, Simplex type audio visual devices with the following characteristic and capacities:

1. Electronic horn model series with a sound rating of 90 dba and temporal pattern per code, and a strobe light with an intensity of 15, 75, and 110 candela (where required).

2. Visual alarm signals model 15, 75 and 110 series shall be furnished with minimum light intensity of 15, 75, and 110 candela complying with the ADA act and the following requirements:

   a. Xenon strobe with a minimum repetition rate of 1HZ, not exceeding 2 HZ and maximum duty cycle of 40% with pulse duration of .2 seconds.
   b. Provide factory-made re-painted steel wire-guard to protect strobe.

3. If more than one strobe in one room or area, all strobes shall be synchronized.

PART 3 – EXECUTION

3.01 DESIGN AND INSTALLATION DRAWINGS:

Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility all other systems interfacing with the fire alarm system.

1. Identify on the drawings, the system address for every addressable device. Signals shall be sequentially numbered as the address of the controlling module.

2. Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring (conduit size and conductor number and AWG size) to the field device terminals.

3. Provide mounting details of FACP and other boxes to building structure, showing fastener type, sizes, material and embedded depth where applicable.

3.02 INSTALLATION:

1. Perform work in accordance with the requirements of NEC, NFPA 70, and NFPA 72.

2. Fasten equipment to structural member of building or metal supports attached to structure, or to concrete surfaces.

   a. Use clamping devices for attaching to structural steel, or when clamping is impractical, obtain written authority to well or to drill.
   b. Fasten equipment to concrete or masonry with expansion anchors.
   c. Fasten equipment to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-taping metal screws.
   d. Do not install conduit raceways and boxes in positions that interfere with the work of other trades.
   e. Attach nameplates on panels or other components as specified.
   f. Use of plastic anchors is prohibited.

3. All fire alarm wiring shall be in conduits.

3.03 CONDUIT:

A. Design conduit run & size between device, control panel and fire alarm equipment. Minimum conduit size shall be ¾ inch.

B. Use rigid steel and 12" or less above floor where subject to mechanical damage, PVC coated rigid steel installed in concrete floors or walls, and installed exposed to the weather. Electrical metallic tubing may be used elsewhere. Schedule 40 rigid PVC conduits for underground outside of building.

C. Install #14 gage galvanized pull wire or 1/8 inch polyethylene rope in conduit installed for future use, and seal the ends.

D. Install concealed conduits as directly as possible and with bend radii as long as possible. Where allowed on drawings, install exposed conduit parallel with or at right angles to building lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at minimum height of 9 feet above floor level or grade.

E. Permanently label or mark at both ends with conduit number of each wire as shown on the drawings. Conduit and junction box labels shall be permanent and conform to the requirements of the National Electric Code, Art. 760.

F. Make elbows offsets and bends uniform and symmetrical. Bend conduit with approved bending devices.

G. Cut conduit ends square, ream and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are pulled.

H. Use galvanized steel lock nuts for attachments to enclosures except threaded hubs may be used where permitted by the NEC. Thread less fittings will not be permitted for rigid conduit. Use Erikson type coupling with running threads.

I. Use one-hole clamps equipped with clamp backs to secure conduits.

J. Install without moisture traps wherever possible. Where practicable, provide drain holes in pull boxes or fittings at low points in systems and remove burrs from drilled holes.

K. Use flexible conduit to made connections to equipment subject to vibrations. Use liquid tight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors. Flexible conduit may be used in lengths not exceeding four feet for other equipment, with the approval of the acceptance inspector.

L. Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, anti-seize, conductive thread lubricant and sealant.

M. Seal openings around conduit at exterior wall penetrations and penetrations of walls forming boundaries between adjoining ventilation zones, using specified sealant. Make all seals waterproof and finish flush with surrounding wall surfaces.

N. Use hangars with 3/8 inch rods for 2 inch conduit or smaller. If conduit is suspended on rods more than 2 feet long, conduit shall be rigidly braced to prevent horizontal motion or swaying.

O. Apply sealing compound in conduit at box or enclosure nearest exterior wall penetration on both sides of wall.

P. Where routing is parallel with hot water or steam pipers, conduits shall not be installed within six inches of the pipe covering. When routing is not parallel with pipes, it is acceptable to install within six inches providing the do not touch the pipes.

Q. Use PVC coated rigid steel conduit below on-grade floor slabs.

1. Install PVC coated rigid steel conduit in accordance with the manufacturer recommendations. Coating damaged during handling or installation shall be repaired using PVC paint recommended by the conduit manufacturer.

3.04. BOXES, ENCLOSURES AND WIRING DEVICES:

A. Boxes shall be installed plumb and firmly in position.

1. Extension rings with blank covers shall be installed on junction boxes where required.

2. Junction boxes served by concealed conduit shall be flush mounted.

3. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

4. Paint all covers of junction boxes red.

3.05 FIRE ALARM TERMINAL CABINET:

A. Provide where shown on drawings and for area larger than 10,000 square per floor, one or more central terminal cabinets location of cabinet to be approved by the Architect) for building zone area fire alarm wiring distribution. Cabinets shall be hinged, with hasp for pad locks and panel I.D.

3.06 CONDUCTORS:

A. Design and provide number conductors and AWG sizes between devices, control panel, annunciation panels and all detached fire alarm equipment.

B. Each conductor shall be identified as shown on the drawing at each with wire markers at every splice and terminal point. Attached permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

1. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

2. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

3. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

C. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

D. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.07. DEVICES:

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within subpanels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.08 SPLICES AND CABLE TERMINATIONS

A. All splices shall be made using solderless connectors or compression type terminal strips. Al connectors shall be installed in conformance with the manufacturer recommendations.

B. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

3.09 CERTIFICATE OF COMPLIANCE (UL):

A. Complete and submit to the Project Engineer in accordance with NFPA 72, paragraph 2.2.2. The equipment installer or supplier shall issue UL certification on the fire alarm system in accordance with the City of Livermore, Alameda County, and the State Fire Marshall requirements.

3.11 FIELD QUALITY CONTROL:

A. Testing, general

1. All intelligent analog devices shall be tested for correct address and sensitivity using test equipment specifically designed for that purpose. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the system address, initials of the installing technician and date.

   a. A systematic record shall be maintained of all reading using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
   b. The acceptance inspector shall be notified before the start of the required test. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
   c. Test reports shall be delivered to the acceptance inspector as completed.

2. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum of conducting the tests:

    a. Ladders and scaffolds as required to access all installed equipment.
    b. Multimeter for reading voltage, current and resistance.
    c. Intelligent device programmer/tester.
    d. Laptop computer with programming software for any required program revisions.
    e. Two way radios, flashlights, smoke generation devices and supplies.
    f. Spare printer paper.
    g. A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.
    h. Decibel meter.

3. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

4. System wiring: fire alarm circuits shall be tested for continuity, grounds, and short circuits.

B. Acceptance testing

1. The engineer in accordance with NFPA will prepare a written acceptance test procedure (ATP) for testing the fire alarm system components and installation 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

2. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving "any", "or", "count", "time", statements; the complete output equation shall be referenced in the matrix.

3. A complete listing of all device labels for alpha-numeric annunciator displays and logging printers shall be prepare by the installing contractor prior to the ATP.

4. The acceptance inspector shall use the system record drawings in combination with the documents specified under paragraph 3.01 during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or

all input and output functions. The items tested shall include but not be limited to the following:

a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation.
b. System evacuation alarm indicating appliances shall be demonstrated.
c. System indications shall be demonstrated as follows:
   (01) Correct message display for each alarm input at the control panel.
   (02) Correct annunciator light for each alarm input at each annunciator.
d. System off-site reporting functions shall be demonstrated.
e. Secondary power capabilities shall be demonstrated.

3.12 NAMEPLATE:

Provide nameplate as required.

3.13 DOCUMENTATION:

A. System documentation shall be furnished to the owner and shall include but not be limited t the following:

1. System record drawings and wiring details including one set of reproducible masters and drawings on 3 ½ inch floppy disks in an AutoCAD 2000.
2. System operation, installation and maintenance manuals.
3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
4. The contractor shall furnish all test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.

3.14 TEST EQUIPMENT

A. The contractor shall furnish all test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.

3.15 SERVICES:

A. The contractor shall warrant the entire system against mechanical and electrical defects for a period described in the contact general conditions. This period shall begin upon completed certification and test of the system or upon first beneficial use of the system, whichever is earlier.

B. The fire alarm system subcontractor or manufacturer shall offer for the owners consideration at the time of system submittal a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72H.

1. The services offered under this contract shall be performed at no charge during the first year after system acceptance and the owner shall have the option of renewing for single or multiple years up to five years at the price quoted upon completion of warranty period.

2. The contractor performing the contract services shall be qualified and listed to maintain ongoing certification of the completed system to the UL for specific installed system listing.

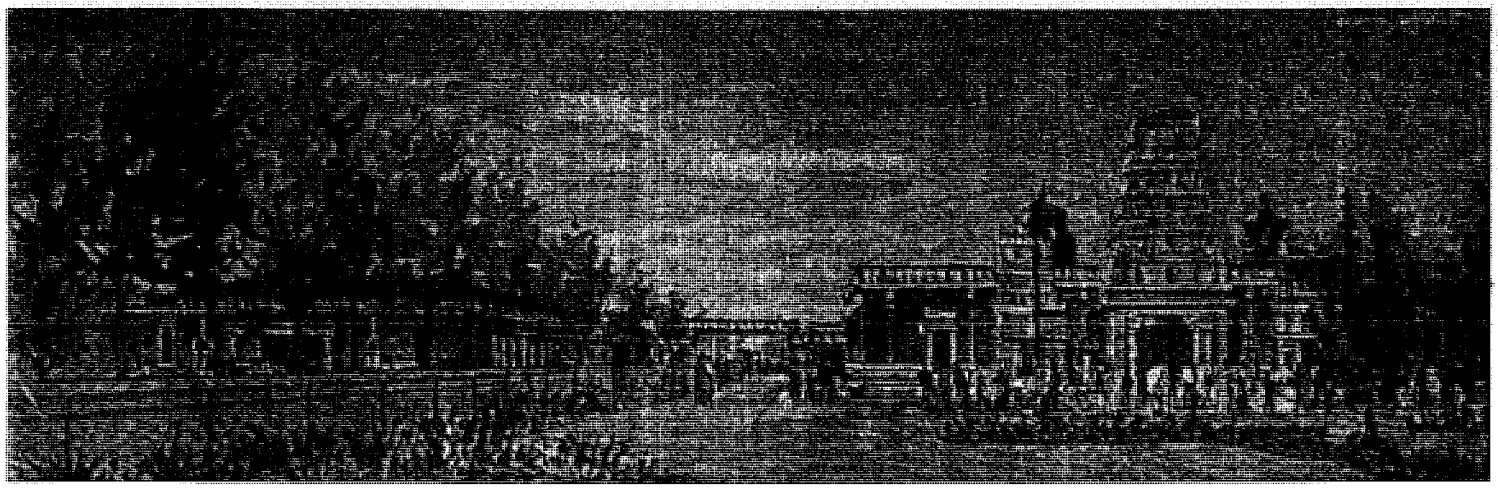
C. The successful bidder shall supply on-site training at the owner's facility. The training shall have a duration of four (4) hours and shall be conducted by a full time employee of the Fire Alarm System Manufacturer.

1. The training shall cover operation and maintenance of the fire alarm system.

END OF SECTION

OUT

Landscape



SECTION 02110

TREE PRESERVATION AND PRUNING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Preservation of trees, care, and pruning of trees to remain in place.

B. Trimming of tree (limbs and tree roots) as may be required to construct the improvements.

C. The work shall include the provision of all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.02 JOB CONDITIONS

A. The Contractor will be held responsible for any damage to trees or other plants, which are to remain during construction, including limb or branch breakage, tearing of bark along trunk or excessive root damage. Large roots greater that 6" in diameter and 12" below ground level shall not be cut without the City's approval.

1.03 QUALIFICATION

A. All tree pruning and removal performed shall be executed by a company having, in full-time employment, an Arborist certified by the Western Chapter of the International Society of Arboriculture. Certification must be verified, and the Arborist must be directly responsible for decisions made, and should visit the work sites daily when trimming of trees and roots is to be performed.

B. Pruning shall be performed to the standards of the International Society of Arborists Pruning guidelines, and to ANSI A-300.

C. Tree pruning shall not occur without first securing a pruning permit. Permit applications shall be submitted to City.

D. Tree removal shall not occur without first securing a tree Removal Permit. For regulations on size description, application procedure and fees, the Contractor shall contact the City.

1.04 APPLICABLE PUBLICATIONS

A. Trees and Building Sites: Official Publication of the International Society of Arboriculture.

B. Arboriculture: The care of trees and shrubs by Dr. Richard Harris

PART 2 – PRODUCTS

None

PART 3 – EXECUTION

3.01 TREE PROTECTION

A. At sites where the excavation has taken place near trees to remain, and many living roots remain exposed to the air, the Contractor shall cover the exposed roots within 2 hours with sand, soil, moist burlap or other means acceptable to the City.

B. Construction materials, debris, and supplies shall not be stored within the drip line or protective fencing area under any tree.

C. Vehicles shall not be parked within the drip line or protective fencing area.

D. Woodchips or another cushioning surface material approved by the City shall be placed over areas where roots are present and construction traffic occurs.

E. Where called for on the plans, place fences or other approved protective barriers around trees to be saved.

3.02 TREE PRUNING

A. Tree pruning shall be performed to balance the crown and eliminate hazards. The main work performed shall be to reduce the sail effect through thinning. reducing end weights, shortening long heavy limbs, removing deadwood, weak limbs and sucker growth. Limbs shall be pruned back to an appropriate lateral branch.

B. All final cuts shall be made at the outer edge of the branch collar. The pruning work shall be performed in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards

C. The Contractor shall be responsible for the preservation of all public and private property. Pruning includes the cutting of limbs, cleanup, removal and disposal of cuttings and debris. Elm logs must be properly disposed of per State Quarantine. Work shall be performed by a two-person crew with one climber, one ground person, a dumping chipper truck and chipper, and any other necessary saws, lines, tools and safety equipment. The work area shall have appropriate cones and signs for safe pedestrian and vehicle traffic.

3.03 ROOT PRUNING

A. Tree roots greater than 3" in diameter and less than 12" below ground level shall not be cut without approval of the City.

B. Roots shall be cut clearly, as far from the trunk of the tree as possible. Root pruning shall be to a depth of 18".

C. Root pruning shall be performed using a Vermeer Root Cutting Machine. Alternate equipment or techniques must be approved by the City.

D. Root pruning shall be completed prior to base or subgrade preparation, or to any excavation adjacent to the tree.

END SECTION 02110

SECTION 02810

IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

1.02 DESCRIPTION:

A. Contractor shall furnish all labor, tools, equipment, product, materials and transportation and perform all operations necessary to properly execute and complete all work in accordance with the Drawings and these Specifications. The intent is to accomplish the work of installing an irrigation system, which will operate in an optimum manner. This intention is to be met foregoing any deficiency in setting a complete detailed description of the work to be done.

B. Related Work Specified Elsewhere:

1. Section 02210: Earthwork and Site Grading
2. Section 02900: Landscape Planting
3. Division 15: Mechanical
4. Division 16: Electrical

1.03 QUALITY ASSURANCE:

A. Reference Standards:

1. ASTM: American Society for Testing and Materials
   a. D1785: Standard Specification for polyvinyl chloride (PVC) plastic pipe, Class 200, Class 315.
   b. D2446: Standard Specification for polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40 and Schedule 80.
2. NSF: National Sanitation Foundation

B. Drawings:

1. For purposes of clarity and legibility, drawings are essentially diagrammatic to the extent that many offsets, bend, unions, special fittings, and exact locations of items are not indicated, unless specifically dimensioned.
2. Exact routing of piping, etc., shall be governed by structural conditions, obstructions. Contractor shall make use of data in Contract Documents.

3. The contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that unknown obstructions, grade difference or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences shall be brought to the attention of the irrigation consultant. In the event this notification is not performed, the contractor shall assume full responsibility for any revision necessary.

1.04 VISIT TO THE SITE:

The contractor shall visit the construction site and shall take all measurements and obtain any other information as may be necessary for a complete and conclusive bid.

1.05 SUBMITTALS:

A. Substitutions:

Prior to installation, any proposed substitution from the plans or these specifications is to be forwarded, in writing, to the irrigation consultant for approval.

B. Record Drawings:

Provide record drawings as follows:

1. The contractor shall maintain in good order in the field office one complete set of prints of all sprinkler drawings, which form a part of this contract. In the event any work is not installed as indicated on the drawings, such work shall be indicated and dimensioned accurately on record drawings as changes occur. Dimension from two permanent points of reference, building corner, sidewalk, road intersections, etc., the location of the following items.

    a. Connection to existing water lines
    b. Connection of existing electrical power
    c. Routing of pressure lines (dimension max. 100 feet lone along routing)
    d. Electrical control valves
    e. Routing of control wires
    f. Quick-coupling valves
    g. Underground stub-outs
    h. Other related equipment as directed by the irrigation consultant

2. Upon completion of the work, obtain reproducible mylar from the landscape architect and neatly correct the plans (to be done by a competent draftsperson) to show the as-built conditions. After the as-builts are reviewed and approved by the irrigation consultant, obtain reduced copies of "as-built" mylar (8-1/2" x 11" sheets or to the smallest readable size), and laminate with weather proofing coating.

C. Operation and Maintenance Manuals:

1. Prior to the final inspection of the irrigation system, furnish two (2) individually bound Service Manuals to the owner. The manuals shall contain the following:

    a. Index sheet indicating the contractor's name, address, and phone number.

b. A copy of the completed guarantee-following the form in these specifications.

c. Certificate of insurance verifying coverage for completed operations.

d. List of equipment with names, addresses and telephone numbers of all local manufacturers' representatives.

e. Copies of equipment warranties and certificates.

f. Complete operating and maintenance instructions of all equipment including exploded drawings and spare parts list.

2. Provide instruction in operation of system to owner's personnel.

D. Hardware Items:

1. Two (2) sets of matching Q.C.V. keys and hose swivels.

2. Two (2) keys to each controller box.

3. Two (2) sets of any special tool required for the maintenance of each type of component used in the sprinkler system.

1.06 PROJECT COORDINATION:

A. Sequencing and Scheduling:

Coordinate irrigation installation work with the installation of other site improvements, including utility installation work and landscape installation.

B. Environmental Conditions:

Site work such as trenching and backfilling shall not be performed during wet, muddy or frozen conditions.

C. Rules and Regulations:

All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code and other applicable state or local laws or regulations. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes.

1. The contractor shall furnish any additional material and labor required to comply with these rules and regulations, though the work is not mentioned in these particular specifications or shown on the drawings.

2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.

D. Safety:

1. The contractor shall erect and maintain barricades, guards, warning signs, and lights as required for the protection of the public and workmen.

2. All work shall be performed in a safe manner. All regulations, all OSHA requirements and other authoritative agencies shall be followed.

3. Prior to commencement of work, locate all underground utilities so that proper precautions may be taken not to damage such improvements.

E. Maintaining Traffic:

It is the responsibility of the contractor to ensure adequate protection and controls for pedestrian and vehicular traffic in the vicinity of the project areas. The contractor shall provide all signs, barricades, flagmen, etc., necessary to meet all traffic requirements for this project at his own expense.

F. Permits and Fees:

The contractor shall obtain all permits and pay all required fees to any governmental agency having jurisdiction over the work and arrange for inspections specified by local ordinances during the course of construction as necessary.

PART 2 - PRODUCTS

2.01 PRODUCT DELIVERY, STORAGE AND HANDLING:

Handling of pipe and fittings: The contractor is cautioned to exercise care in handling, loading, unloading, and storing of pipe and fittings. Cracks can occur from sudden impact. Protect all plastic products from excessive exposure to sunlight. Any section of pipe that has been dented or damaged shall be removed from the site and, if installed, shall be replaced with new undamaged piping.

2.02 MATERIALS:

A. PVC Pressure main line piping and fittings:

1. Pressure main line piping: 1120-Schedule 40 PVC plastic pipe. Fittings shall be Schedule 40 PVC solvent weld.

2. Pipe shall be made from NSF approved, Type 1, Grade 1 PVC compound conforming ASTM D1784. All pipe shall meet requirements set forth in ASTM D2441 with an appropriate standard dimension ratio.

3. All PVC pipe shall bear the following markings:

   a. Manufacturer's name
   b. Nominal pipe size
   c. Schedule or class
   d. Pressure rating in PSI
   e. NSF

f. Date of extrusion

4. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.D. schedule and NSF seal of approval.

B. PVC non-pressure lateral line piping and fittings:

1. Non-pressure buried lateral line piping shall be PVC 1120 Class 200 with Schedule 40 PVC solvent-weld fittings.

2. Pipe shall be made from NSF approved, Type 1, Grade 1 PVC compound conforming to ASTM D1784. All pipe shall meet requirements set forth in ASTM D2441 with an appropriate standard dimension ratio.

3. Except as heretofore specified, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as specified.

C. Sleeving and Conduit: Material shall be polyvinyl chloride (PVC) Schedule 40, type 1120/1220 with solvent weld.

D. Galvanized steel pipe shall be Schedule 40; ASTM (A120) and steel fittings shall be Schedule 40 hot dipped, double banded malleable steel.

E. PVC Schedule 80 nipples shall be used with molded threads. Machined threaded nipples will not be allowed.

F. Connections between supply line and R.C.V.'s shall be as specified or detailed on the drawings.

G. Riser assemblies shall be as specified or detailed on the drawings.

H. Controller(s), valves, backflow preventer(s) and sprinkler heads shall be specified and/or detailed on the drawings.

I. Control wires shall be UL approved copper single strand type UF direct burial 14 gauge red in color. Common wires shall be UL approved copper single strand type UF direct burial 12 gauge white in color. Spare control wires shall be UL approved copper single strand type UF direct burial 14 gauge blue in color.

J. Miscellaneous installation materials:

1. Solvent weld joints shall be of make and type approved by manufacturer (s) of pipe and fittings. Solvent cement shall be a proper consistency throughout use. Mixing thinner with solvent will not be allowed.

2. Pipe joint compound shall be non-hardening, non- toxic materials designed specifically for use on threaded connections in water carrying pipe.

3. Wire connections shall be 3M #3750 Scotch Lok Seal Packs, Spears DS-400 seal packs or approved equal.

K. Thrust Blocks: Concrete thrust blocks shall be as detailed on the plans.

L. Control or Valve Boxes:

1. Provide 14 x 19 inch plastic rectangular control valve box with bolt down plastic lid for each electrical control valve. Hot stamp or permanently engrave irrigation controller station number onto valve box lid.

2. For gate valves and quick coupling valves: Use 9-inch plastic round box. Add extensions for gate valves as required. Hot stamp or permanently engrave "GV" for gate valve and "QCV" for quick coupler valves onto valve box lid.

PART 3 - EXECUTION

3.01 GENERAL:

A. Irrigation system shall be installed in accordance with all applicable local and state codes and ordinances by a licensed landscape contractor.

B. Follow manufacturer's direction except as shown or specified.

3.02 INSPECTION OF SITE CONDITIONS:

A. All scaled dimensions are approximate. The contractor shall check and verify all size dimensions prior to proceeding with work under this Section.

B. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.

C. Coordinate installation of irrigation materials, including pipe, so there shall be no interference with utilities or other construction or difficulty in planting trees, shrubs, and groundcover.

D. Avoid trenching within drip line of trees where possible. When not possible, all damaged roots over 1-1/2" in diameter shall be cut leaving clean face, seal cuts with tree seal, then immediately install pipe, wire, etc., refill trench and soak.

E. The contractor shall carefully check all grades to satisfy himself that he may safely proceed before starting work on the irrigation installation.

F. Coordinate the work of this Section with that of other Sections for the location of pipe sleeves through walls, paving, etc.

G. The landscape contractor shall verify water pressure and available gallonage prior to construction. If deficiencies are noted that will hinder the system's performance, notify the irrigation consultant for directions to correct deficiencies.

H. The design is diagrammatic. All piping, valves, etc., shown within paved areas is design clarification only. Install piping, valves, etc., in planting areas.

3.03 PREPARATION - LAYOUT OF WORK:

Prior to installation, stake out all pressure supply lines, routing and location of sprinkler heads and notify irrigation consultant for reviewing layout when area or grade differences or obstructions are not as indicated on the plans.

3.04 INSTALLATION:

A. Trenching:

1. Dig trench straight and support pipe continuously on bottom of trench. Lay pipe to an even grade. Trenching excavation shall follow layout shown on drawings.

2. Provide for a minimum of 18 inches cover for all pressure supply lines.

3. Provide for a minimum cover of 12 inches for all non-pressure lines to spray heads.

4. Provide for a minimum cover of 18 inches for all control wiring.

5. Provide a minimum cover of 24 inches over pipe and wiring under asphalt pavement.

B. Backfilling:

1. In accordance with requirements of SECTION 02215, "EXCAVATION AND BACKFILLING".

2. Do not backfill trenches until all required tests are performed. Carefully backfill trenches with specified excavated materials for backfilling, consisting of earth, loam, sandy clay, sand, or other acceptable materials, free from large clods of earth or stones. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill shall conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

3. Surround pipe with sand in rocky terrain with a 4" bed and 4" cover.

4. Backfill in proposed asphalt paved areas shall have sand covering pipe with a 6" minimum depth.

C. Pipe and Fitting Installation and Connections:

1. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.

2. Install all assemblies specified herein in accordance with details shown on drawings.

3. Thoroughly clean PVC pipe and fittings of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

4. On PVC to metal connections, the contractor shall work the metal connections first. Use Teflon tape, or equal, on all threaded PVC to PVC, and on all treaded PVC to metal joints.

5. Install piping under existing walks by boring whenever possible. Where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced at no increase in contract sum. Obtain permission to cut or break sidewalks and/or concrete from the architect before proceeding. No hydraulic driving will be permitted under concrete paving.

D. Line clearance:

All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

E. Automatic Controller:

1. Locate controller in general location shown with exact placement to be determined at job site by the irrigation consultant or Owner's Representative.

2. Connect control lines to controller in sequential arrangement according to assigned identification number on plans.

3. Controller shall be properly grounded per Article 250 of the National Electric Code and conform to local regulations.

F. Remote Control Valves:

Install where shown on drawings. When grouped together, allow at least 12 inches between valves. Install each remote control valve in a separate valve box. Locate boxes in groundcover areas whenever possible, and a minimum of 12 inches from paving or curbs.

G. Control Wiring:

1. Make connections between existing automatic controls and electrical control valves with direct burial copper wire. Common wires shall be white. Install in accordance with valve manufacturer's specifications and wire charts.

2. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible. When not possible, house wiring in PVC conduit as described in "Sleeving and Conduit" section.

3. Where more than one wire is placed in a trench the wiring shall be taped together at intervals of 10 feet.

4. Provide 2-foot expansion coil at each wire connection and at least every 100 feet of wire length on runs more than 100 feet in length. Form expansion coils by wrapping at least five turns of wire around a 1-inch diameter pipe, then withdrawing the pipe.

5. Splicing on runs shall be placed in junction boxes. Indicate all splices on the <u>As-Built Plan.</u>

6. All below grade wire connections shall be made by using heat shrink tubing with interwall sealer following manufacturers recommended procedures.

7. Install separate common wire for each controller. Install extra control wires of a different color through all valve boxes to controller as indicated in irrigation notes on plans.

H. Sleeving and Conduit:

1. Control wiring passing under proposed concrete and paving shall pass through Schedule 40 PVC conduit-size as required.

2. Sleeving and conduit shall extend six (6") beyond farthest edge of pavement or curb.

3. Provide removable non-decaying plug at ends of sleeves and conduits to prevent entrance of earth.

I. Flushing of System:

1. After all new pipelines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, open control valves and use a full head of water to flush out the system.

2. Install sprinkler head only after flushing of system has been accomplished.

J. Sprinkler Heads:

1. Install sprinkler heads as shown on Drawings.

2. Spacing of heads shall not exceed maximum shown on Drawings. In no case shall spacing exceed maximum recommended by manufacturer.

3.05 FIELD QUALITY CONTROL:

A. Adjustment of the System:

1. Flush and adjust all bubblers for optimum performance and to prevent overspray onto walks, roadways and buildings.

2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzles sizes and degrees of arc as required.

3. Lowering raised sprinkler heads by the contractor shall be accomplished within ten days after notification.

B. Testing of Irrigation System:

1. Notify the irrigation consultant at least three (3) days in advance of testing.

2. Test to be done at no extra cost to the Owner.

3. Center load piping with sufficient amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.

4. Testing of pressure main lines shall occur prior to installation of electrical control valves.

5. Pressure Test for Solvent Weld Pipes:

   a. Apply test for solvent welded plastic pipe after joints have cured at least 24 hours or more it manufacturer of solvent cement requires.

   b. Test supply lines per ASTM-F690 as follows: (1) add water slowly to pipe to avoid water hammer damage, (2) bleed system to insure all air is out of pipes, (3) pressurize system to 125 psi for two (2) hours. Visually inspect for leaks while system is holding pressure constant. Note – use hydraulic pump or other safe method – do not use air compressor.

   c. Test sprinkler lines at line pressure and visually inspect for leaks.

6. When the irrigation system is completed, perform a coverage test to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviation from drawings. This test shall be accomplished before any plant material is planted.

7. Upon completion of each phase of work, test and adjust entire system to meet site requirements.

3.06 CLEAN-UP:

Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.

3.07 FINAL REVIEW PRIOR TO ACCEPTANCE:

A. Operate each system in its entirety at time of final review. Any items deemed not acceptable shall be reworked to the satisfaction of the irrigation consultant.

B. Final review shall take place after submission of all specified lists, record drawings, and manuals.

3.08 INSPECTIONS:

The contractor shall be subject to inspections at any and all times by authorized representatives of the Owner.

3.09 MAINTENANCE:

The contractor is to make all repairs and maintain the entire sprinkler system from the time of installation through the landscape maintenance period.

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

WE HEREBY GUARANTEE THAT THE SPRINKLER IRRIGATION SYSTEM WE HAVE FURNISHED AND INSTALLED IS FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP, AND THE WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS. WE AGREE TO REPAIR OR REPLACE ANY DEFECTS IN MATERIAL OR WORKMANSHIP, ANY SETTLING OF BACKFILLED TRENCHES, WHICH MAY DEVELOP DURING THE PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE AND ALSO TO REPAIR OR REPLACE ANY DAMAGE CAUSED BY ANY DEFECTS IN THE IRRIGATION SYSTEM OR RESULTING FROM THE REPAIRING OR REPLACING OF SUCH DEFECTS AT NO ADDITIONAL COST TO THE OWNER. ORDINARY WEAR AND TEAR, UNUSUAL ABUSE OR NEGLECT ARE EXCEPTED. WE SHALL MAKE SUCH REPAIRS OR REPLACEMENTS, INCLUDING COMPLETE RESTORATION OF ALL DAMAGED PLANTING, PAVING, OR OTHER IMPROVEMENTS OF ANY KIND, WITHIN A REASONABLE TIME, AS DETERMINED BY THE OWNER, AFTER RECEIPT OF WRITTEN NOTICE. IN THE EVENT OF OUR FAILURE TO MAKE SUCH REPAIRS OR REPLACEMENTS WITHIN A REASONABLE TIME AFTER RECEIPT OF WRITTEN NOTICE FROM THE OWNER, WE AUTHORIZE THE OWNER TO PROCEED TO HAVE SAID REPAIRS OR REPLACEMENTS MADE AT OUR EXPENSE AND WE WILL PAY THE COSTS AND CHARGES THEREFORE UPON DEMAND.

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____

LICENSE NO: _____

ADDRESS: _____

TELEPHONE: _____

GUARANTEE TO: _____

_____

_____

DATE OF ACCEPTANCE: _____

AUTHORIZED REPRESENTATIVE: _____

END OF SECTION 02810

SECTION 02870

SITE FURNISHINGS AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

A. The General Conditions and all other Contract Documents for this project are complementary and applicable to this Section of the Specifications.

B. Work Included: Furnish all labor, materials, equipment and services necessary to provide and construct, repair, or install the site elements, complete in place, as shown and specified, including, but not limited to:

1. Benches
2. Bike Racks
3. Trash Enclosure

C. Related Work:
Section 03340: Site Concrete Work

1.02 SUBMITTALS

A. Submit shop drawings where noted to the Owner for approval before installing any manufactured items. Plans shall include dimensions, color, finish, structural design (custom items), and connection details.

B. Submit catalog cuts, samples and manufacturers literature of all manufactured items in this section to the Owner for approval before installation.

1. Provide color samples, brushouts, or charts for all items. Final colors to be selected by Owner and a sample submitted for approval.

PART 2 – PRODUCTS

2.01 MANUFACTURED ITEMS

A. Benches: per plans, by Owner

B. Bike Racks: per plans, by Owner

C. Trash Enclosure: Final Materials to be selected by Owner and samples submitted for approval.

2.02 MISCELLANEOUS MATERIALS

A. All other materials for site elements shall be as specified on the plans and these specifications.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Examination: Verify that conditions are satisfactory for installation of each item of site elements. If unsatisfactory conditions exist, do not begin installation until such conditions have been corrected.

B. Benches and Bike Racks

1. Install directly onto concrete. Use manufacturer's recommended adhesive.

3.02 GUARANTEE

A. At completion of project, Contractor shall provide Owner with written guarantee from each manufacturer identifying the nature of warranty for each product component.

B. Contractor shall provide Owner with two (2) bound maintenance manuals identifying each piece of equipment on manufacturer's recommended maintenance program including, but not limited to, daily, weekly, and monthly check lists.

C. Contractor to provide Owner with minimum of one (1) gallon each type and color of paint used on apparatus with recommended surface preparation and application guidelines.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

The Site Elements shall be measured as follows:

1. Benches shall be per each
2. Bike Racks shall be per each

The contract unit price for the actual quantity of each item installed, and shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for providing and installing all site elements as shown on the plans and as specified in these specifications. Payment shall only be made for installed elements as approved by the Owner.

END OF SECTION 02800

SECTION 02900

LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The General and Supplementary Conditions and General Requirements apply to the work herein specified.

1.02 DESCRIPTION:

A. Work to be Included:

1. Furnish and place topsoil, fertilizer, organic materials, and all other materials incidental to planting work.

2. Furnish all plant materials (trees, shrubs, seed, ground covers, and plant labels).

3. Furnish all labor, equipment and materials necessary for the installation of plant materials according to these Specifications.

B. Related Work Described Elsewhere:

1. Irrigation: Irrigation system shall be installed and operative before beginning planting operation.

2. Drainlines and Utilities: Contractor shall fully acquaint himself with the existing conditions particularly in reference to underground piping. Any damage caused by the Contractor to work of other trades shall be repaired by him at no cost to the Owner.

3. Earthwork: Close coordination shall be maintained with those Contractors performing rough grading operations and installing utilities and pavement to insure proper timing of the work.

1.03 REQUIREMENTS OF REGULATORY AGENCIES:

A. Perform work in accordance with all applicable laws, codes, and regulations required by the City of Livermore and any other authorities having jurisdiction over such work. Provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

B. Certificates of inspection required by law for transportation shall accompany invoice for each shipment of plants. File copies of certificates with Owner's Representative after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection of plants at project site.

1.04 QUALITY ASSURANCE:

A. Personnel: All planting and lawn work shall be performed by personnel familiar with lawn and planting procedures under the supervision of a qualified foreman.

B. Codes and Standards: Nursery stock shall meet the standards of the current edition of the "Agricultural Code of California" and the "Regulations of the Director of Agriculture Pertaining to Nursery Stock" as to grading and quality. They shall be true to type and name in accordance with "Standardized Plant Names", Second Edition.

C. Substitutions: Substitutions of plant materials will not be permitted unless authorized in writing by Owner's Representative. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. Such proof shall be substantiated and submitted in writing to Owner's Representative at least 30 days prior to start of work under this Section. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

The Landscape Architect reserves the right to require the Contractor to replace at the Contractor's cost any plants which the Contractor has installed without the Landscape Architect's approval.

D. Plants shall be subject to inspection and approval of the Landscape Architect at place of growth or upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Wherever the terms "approve", "approval" or "approved" are used herein they mean approval of the Landscape Architect in writing.

E. Plant Certification: All plants must meet specifications of Federal, State, and County laws requiring inspection for plant disease and insect infestations. Inspection certifications required by law shall accompany each shipment, invoice and order for stock.

1.05 SUBMITTALS:

A. Furnish 6 copies of manufacturers' literature for the following items:

1. Fertilizer
2. Mulch
3. Lawn seed

B. Provide analysis from an approved testing laboratory for:

1. Topsoil
2. Organic Amendment

C. Submit one (1) quart sample each of mulch and organic amendment.

D. All submittal data shall be forwarded in a single package to the Landscape Architect within 60 days of award of the contract.

1.06 SAMPLES AND TESTS:

A. Owner's Representative reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request by Owner's Representative. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of testing of materials not meeting specifications shall be paid by Contractor.

1.07 SELECTION AND TAGGING OF PLANT MATERIAL:

A. Plants shall be subject to inspection and approval by Landscape Architect at place of growth if the Landscape Architect so chooses, and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Submit written request for inspection of plant material at place of growth to Landscape Architect. Written request shall state the place of growth and quantity of plants to be inspected. Landscape Architect reserves the right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

OR

B. Plants identified as "selected specimen" shall be approved and tagged at place of growth by Landscape Architect. For distant material, submit photographs for pre-inspection review.

1.08 JOB CONDITIONS:

A. Delivery:

1. Deliver standard products to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade mark and conformance to state law.

2. Deliver plants with identification labels.
   a. Labels should state correct name and size.
   b. Use durable, water-proof labels with water resistant ink that will remain legible for at least 60 days.

3. Protect plant materials during transport to prevent damage to rootball or desiccation of leaves.

4. Remove unacceptable plant materials immediately from job site.

B. Storage:

1. Contractor shall maintain the plant material properly between delivery and planting. This includes protection from animals and vandals, proper watering, and feeding if necessary.

2. Shade plants shall be stored in the shade, and sun plants shall be stored in the sun.

C. Timing: Under no circumstances shall any work be performed if the temperature exceeds 90 degrees or is below 40 degrees. No planting shall be done with the soil saturated with water.

1.09 PROTECTION OF EXISTING PLANTS TO REMAIN:

A. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of any existing plant to remain except as actually required for construction in those areas.

B. Provide barricades, fences or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.

C. Notify Owner's Representative in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing plants to remain.

D. If existing plants to remain are damaged during construction, Contractor shall replace such plants of the same species and size as those damaged at no cost to Owner. Determination of extent of damage and value of damaged plant shall rest solely with Owner's Representative.

PART 2 - PRODUCTS

2.01 SOIL AMENDMENTS:

A. The following organic amendments, soil amendments, and fertilizer rates and quantities are to be used for bid basis only. Contractor shall arrange and pay for testing by an accredited soils laboratory of existing site soil after rough grading operations are complete, and shall amend the soils according to said laboratory's recommendations. The soils recommendations shall be considered a part of this specification.

B. Topsoil: Provide topsoil as required to complete landscape work. Topsoil to be furnished shall be fertile and friable, possessing characteristics of representative productive soils on the site. It shall not contain toxic substances which may be harmful to plant growth. If herbicide contamination is suspected then a radish/rye grass growth trial must be performed. Consult with Landscape Architect prior to decision to test. It shall be uniformly textured and free of all objectionable foreign materials, oil, or chemicals which may be injurious to plant growth. Natural topsoil shall possess a pH factor between 5.5 and 7.5, a sodium absorption ratio (SAR) of less than 8, a boron concentration of the saturation extract of less than 1 ppm, and salinity of the saturation extract at 25 degrees C. of less than 4.0 millimhos per centimeter.
Obtain topsoil from naturally well- drained sites where topsoil occurs in a depth of not less than 4 inches; do not obtain from bogs or marshes. Topsoil from the project stockpile which meets the requirements is acceptable.

C. Imported Topsoil: Topsoil shall be tested by an approved soils laboratory for compatibility with existing on-site soils and fertility. Contractor shall submit soil laboratory's analysis and amendment recommendations. Imported topsoil shall be

subject to inspection by Landscape Architect at the project site. Remove rejected topsoil immediately at Contractor's expense.

D. Organic Amendment:

1. Nitrified fir bark having a minimum organic content of 94% and a nitrogen content of 0.8% minimum to 1.2% maximum on a dry weight basis. Fir bark shall be shredded to pass a 1/4" mesh screen. Six cubic yards per 1,000 square feet.

E. Fertilizer:

1. Lawn and groundcover areas:

a. 6N-20P-20K, 25 lbs. per 1,000 square feet.
b. Starting one month after planting, on a monthly basis, 21N-0P-0K Ammonium sulfate. 5 lbs. per 1,000 square feet.

2. Shrubs and trees:

a. 21 gram 20N-10P-5K slow release fertilizer tablets as manufactured by Agriform. Apply according to Manufacturer's instructions.
b. After planting: 21N-0P-0K Ammonium sulfate 5 lbs. per 1,000 square feet.

2.02 **TOP MULCH:** Fir bark chips having a maximum size of 1" diameter.

*2.03 **GRASS SEED:**

A. Grass seed shall be fresh, clean, new crop seed having purity of 98.5% and a minimum germination rate of 83%. Seed mix shall be mixed in the proportions by weight shown:

Dwarf Tall Fescue
80% Bonsai
20% Pixie

Apply at a rate of 10 lbs. per 1,000 square feet.

B. Seed shall be mixed by dealer. Furnish dealer's guaranteed statement of composition, mixture and percentage of purity and germination of each variety to Landscape Architect.

OR

*2.03 **SOD:** Sod shall be one year old and dense with grass, having been mowed at 1 in. height before lifting from field. All grown on fumigated soil. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects. Sod shall be grown of seed mix of the following proportions by weight:

Dwarf Tall Fescue:
80% Bonsai
20% Pixie

2.04 GROUNDCOVERS, TREES, AND SHRUBS:

A. All plant materials shall be nursery grown in accordance with the best known horticulture practices and under climatic conditions similar to those in the locality of the project. Container stock shall have grown in the containers in which delivered for at least six (6) months, but not over two years. No container plants that have cracked or broken balls of earth when taken from container shall be planted except upon special approval by Landscape Architect.

B. Plants shall be vigorous and shall have a normal habit of growth. Plants shall be free of damage by insects, pests, diseases or wind; burns from insecticides or fertilizer; and stunted growth due to lack of water, lack of food, diseases, or other causes. Plants shall be in conformity with the sizes shown on the drawings.

C. Trees: Unless otherwise specified, tree trunks shall be straight with leader intact, undamaged, and uncut. All old abrasions and cuts are acceptable only if completely callused over.

D. Quantities: Quantities necessary to complete the work as shown on the drawings shall be furnished.

E. Root Systems: All shrubs and trees shall have a normal root system. No plants with roots that have encircled themselves will be accepted. In case of any unsatisfactory root system, a total group of plants may be rejected.

* F. Balled and Burlapped Trees: Plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if approved by Landscape Architect. Use of such plants shall not increase Contract price. If larger plants are approved, the ball of earth shall be increased in proportion to the size of the plant. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on tree trunk 6 inches above natural ground line for trees up to 4 inches in caliper and at a point 12 inches above the natural ground line for trees over 4 inches in caliper. If a range of size is given, no plant shall be less than the minimum size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required.

2.05 WATER SOURCE:

A. Water source shall be provided by Owner. Contractor shall provide transport as required.

2.06 ROOT GUARDS: Deep Root Model UB 36-2 shall be used on all trees 6' or closer to pavement, utilities, curbs, etc. Deep Root (415) 344-1464.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS:

A. Inspections by the Landscape Contractor:

1. Prior to all work in this section, verify grades and carefully inspect the installed work of all other trades. Verify that all such work is complete to the point where the installation may properly commence.

2. In the event of discrepancy, immediately notify the Landscape Architect. Do not proceed with this installation in areas of discrepancies until all such discrepancies have been fully resolved.

3. Inspect trees, shrubs and ground cover plants for injury, insect infestations, and proper pruning.

4. Landscape Contractor shall receive site graded to ±0.10 ft. of finish grades shown on the Drawings. Allow for depth of soil amendments and mulch in determining the difference between finished subgrade in groundcover and shrub beds. Verify that subgrades are not compacted. Do not proceed until detrimental conditions are corrected.

3.02 SOIL PREPARATION:

A. The Contractor shall prepare the site for landscaping. In the areas designated for landscaping on the plans, he shall, prior to placing imported material, replacing existing topsoil, or doing any planting, clear the areas of weeds, roots, debris, rocks, and underground obstructions, and construction debris to a depth acceptable for planting. Scarify the subgrade to a 3" minimum depth prior to spreading topsoil.

B. Cultivation and Placement of Amendment:

1. In areas to be planted with shrubs cultivate to a depth of 12".

2. In lawn and groundcover areas, cultivate soil to a depth of 8". Incorporate 6 cubic yards per 1000 square feet of nitrified fir bark. Prior to planting incorporate to a depth of 6" the following fertilizers, per 1000 square feet:

   25 lbs. 6N-20P-20K

3. Areas within the driplines of existing trees shall be hand cultivated.

C. Finish Preparation in Lawn Areas:

1. Roll to compact amended soil to not more than 85% compaction. Finish grade shall be 1" below adjacent paving, curbs, or walls unless otherwise shown on drawings. Finish out to smooth, even surface conforming to established grades after settlement. Rake immediately prior to planting.

2. If rain is likely between completion of soil preparation and planting, precautions shall be taken to prevent erosion of the soil.

D. Soil Mix for Backfill of Shrubs and Trees: The following ingredients shall be tumbled to achieve a homogeneous mix:

Organic amendment	1 cubic yard
Topsoil	3 cubic yards

E. Soil Mix for Backfill of Pots: The following ingredients shall be tumbled to achieve a homogeneous mix:

Organic amendment	1 cubic yard
Topsoil	3 cubic yards

Top dress each pot with one pound of Osmacoat 17-7-12 fertilizer.

3.03 SHRUBS AND TREES:

A. Preparation:

1. Stake out location for plants and outline of planting beds on ground and obtain the approval of Landscape Architect before digging.

2. The Contractor shall protect all utilities, vegetation, and structures during work.

3. Trees shall be located a minimum of 3' from walls, overheads, walks, headers, and other trees within the project. If conflicts arise between size of areas and plans, Contractor shall contact Landscape Architect for resolution. Failure to make such conflicts known to the Landscape Architect will result in Contractor's liability to relocate the materials.

B. Excavation:

1. All plant pits shall be dug with vertical walls. The sides and bottoms of all planting pits shall be thoroughly scarified.

2. Holes for one (1) gallon size plants: Twelve (12) inches wider than the can and six (6) inches minimum deeper.

3. Holes for (5) gallon size plants: eighteen (18) inches wider than the can or root ball, and eight (8) inches deeper than can or root ball.

4. Holes for fifteen (15) gallon size plants or larger: Twenty-four (24) inches wider than the can or root ball, and twelve (12) inches deeper than the can or root ball.

C. Plants in Containers:

1. Plants shall be removed carefully from their containers after the containers have been cut on two sides minimum; fifteen-gallon containers shall be opened in three places. In the case of boxed plant specimens, the wood shall be removed at the sides and at the bottom of the box.

2. After removing plant material from its container, stimulate root growth by making four or five vertical cuts 1" deep around the circumference of the root ball.

3. Do not lift or handle plants by the top, stems, or trunk at any time. All plants shall be lifted in such a manner that the root ball is supported from the underside.

4. The Contractor shall check all plants for adequate root systems. If the root system is defective, he shall remove deficient plants from the site and replace them with new ones.

D. Balled and Burlapped Material: Dig balled and burlapped (B&B) plant with firm, natural balls of earth, of diameter not less than that recommended by USA Standard for Nursery Stock, and of sufficient depth to include the fibrous and feeding roots. Plants moved with a ball will not be acceptable if the ball is cracked or broken before or during planting operations.

E. Planting:

1. Center plant in pit or trench over tamped mound.

2. Face for best effect.

3. Set plant plumb and hold rigidly in position.

4. All plants shall be set in the ground so that the root ball will be flush with the finish grade. All plants that settle below the finish grade within 30 days of acceptance of the work shall be replanted in the proper position. In case a total section of planting area settles, the Contractor shall lift the plants, import additional soil mix, regrade, and replant, at no additional cost to the Owner.

5. Use soil mix only for backfill. Backfill pit with soil mix in 9" layers and water each layer thoroughly to settle soil. The filled pit shall be flush with surrounding grade when complete.

6. When the plant pit has been approximately one half filled, place planting tablets according to the manufacturer's schedule.

7. Apply post-planting fertilizer.

8. In shrub mass areas, mulch area between plant pits with 3" layer of fir bark for weed control.

9. Planting operation for plants in raised concrete planters is same as above except that finish grade of soil mix shall be 1 1/2" below top of planter walls. Planters may be backfilled with excess topsoil up to the depth specified for plant pits above which backfill shall be soil mix.

10. Planting operations for plants in precast planters is the same as stated in paragraph 9 above. Fill entire planter with soil mix. Place planters as shown on planting plans.

* 11. In areas noted on Drawings where acid-loving plants will be installed, use the following planting mix:

2 parts amended soil
1 part fine sand
1 part peat moss

Immediately after plants are installed, apply Iron Sequestrene at the rate and in the method recommended by the manufacturer.

3.04 GROUNDCOVER AREAS:

A. Planting:

1. Space plants equally and uniformly at spacings indicated on the Drawings, which are the maximum and in a triangular pattern.

2. Plant pits shall be sufficiently large so that the root can be freely suspended in the pit. After backfilling the pit, firm the soil so that there will be no air space around the roots.

3. Apply post-planting fertilizer.

4. Mulch all ground cover areas with 1" to 1 1/2" layer of fir bark.

3.05 LAWN SEEDING:

A. Inspection:

Upon the completion of the placing of the soil and prior to seeding, the Contractor shall call for an inspection of the lawn irrigation system. The seeding shall commence after the Landscape Architect is satisfied that the irrigation system is operating satisfactorily and finish grade is in accord with the Drawings.

B. Seeding:

1. After seed bed has been prepared, distribute the grass seed mixture evenly over the surface of the lawn area.

2. After the seed has been sown, evenly spread the fertilizer over the entire lawn area. Lightly rake the entire area to cover seed, maximum cover 1/4".

3. Top dress with minimum of 1/8" of peat moss.

4. Immediately after completion of planting, the seeded area shall be watered with a fine spray to provide a one-inch depth of penetration into the soil, and the top surface shall not be allowed to dry out at any time until after germination. Reseed areas which do not germinate.

5. Application of lawn seed by hydroseed and hydromulch method may be done at Contractor's option. All above provisions of soil preparation apply. If the hydroseed method is used materials shall be mixed and applied in the following proportions:

Wood Fiber	2000 lbs/acre
Seed Mix	See Part II Products above
Water	as needed for application

The slurry shall be applied within 60 minutes after the seed has been added to the slurry.

C. All newly seeded turf areas shall be free of broadleaf weeds. Infested areas shall be treated by the Contractor with a selective broadleaf herbicide.

D. At the time of final inspection, the lawns shall be dense, green, and weed free. It is the Contractor's responsibility to eliminate any bare spots, dead areas, and weeds.

OR

3.05 SOD LAWN:

A. Inspection:

Upon the completion of the placing of the soil and prior to placing sod, the Contractor shall call for an inspection of the lawn irrigation system. The sod shall be placed after the Landscape Architect has satisfied himself that the irrigation system is operating satisfactorily and finish grade is in accord with the Drawings.

B. Laying Sod:

1. Remove all rubble, sticks, rocks and stones 1" or larger from top 2" amended soil.

2. Lay sod without stretching. Stagger end seams and butt edges as close as possible to each other. Roll with sod roller perpendicular to direction it was laid.

3. Apply post-planting fertilizer.

4. Irrigate to an 8" soil depth immediately after planting and then irrigate lightly every day to maintain adequate moisture level through establishment period.

5. Arrange for delivery of sod in the morning to insure same-day installation.

C. At the time of final inspection the lawns shall be dense, green, and weed free. It is the Contractor's responsibility to eliminate any bare spots, dead areas and weeds.

3.06 TREE STAKING:

A. Stake trees as indicated on the Drawings.

B. Tying: Find the proper support height by holding the trunk in one hand and pulling the top to one side and releasing it. The lowest height at which the trunk will return to the upright position when the top is released, is the height at which to attach tree ties.

3.07 PRUNING:

A. Tree and Shrub: Pruning shall be performed as required to maintain a natural appearance, promote healthy and vigorous growth, and eliminate diseased or damaged growth.

B. Trees shall be pruned to thin crown and avoid wind damage, eliminate narrow V-shaped branch forks that lack strength, eliminate sucker growth, and maintain a radial branching pattern to avoid crossing branches.

C. Under no circumstances will stripping of lower branches ("raising-up") of young trees be permitted. Lower branches shall be retained in a "tipped back" or pinched condition with as much foliage as possible to promote caliper trunk growth (tapered trunk).

D. Major pruning of trees to compensate for root loss or for aesthetic reasons shall be done only with approval of the Landscape Architect.

E. Shrubs shall not be clipped into balled or boxed forms, unless such is required by the design and directed by the Landscape Architect.

F. All pruning shall be made flush to lateral branches, buds, or trunk. "Stubbing" will not be permitted.

G. Damage: All cuts over 1" resulting from pruning or wind breakage shall be inspected periodically for insect infestation or disease.

3.08 CLEAN UP:

A. Keep all areas of work clean and neat at all times. Upon completion of planting, all cans, boxes, and other debris that is a part of the planting operation shall be removed from the site.

B. All pavements shall be washed off, and site shall be left in an absolutely clean condition. All planting areas shall be cultivated and weed free before final inspection. Clean-up operations shall take place throughout the course of work so that walks and drives are clean at all times.

3.09 INSPECTIONS:

A. Notification: The Contractor shall notify the Landscape Architect a minimum of 72 hours before requiring a visit by the Landscape Architect or his duly appointed representative to the site.

B. Check Points: The following shall be considered check points and the Contractor shall only proceed with the work after the Landscape Architect has visited the site and determined that the work is proceeding satisfactorily.

1. Completion of placement of soil mix and fine grading, prior to sodding or seeding of lawn.

2. When plant material is placed in the configuration shown on the Drawings before planting.

3. A check visit shall be made to begin the maintenance period. At this time the Contractor shall have completed all phases of the Plans and Specifications. Any discrepancies shall be noted at that time and the Contractor shall make appropriate corrections before the acceptance of the work.

4. A conference including the Owner shall be held at the completion of the work, provided that all deficiencies brought out in the check visit which began the maintenance period have been corrected by this time. The Contractor shall continue to maintain the project at his own expense until all deficiencies have been corrected, at which time the Contractor shall request the Landscape Architect to visit the site and approve the project as complete. The Landscape Architect will accept the landscape project in writing. The date of the acceptance letter shall be the first day of the guarantee period.

C. Should it be determined at the Final Inspection or Final Acceptance visit that any punchlist item is incomplete, any further review of the site will be terminated until all items are guaranteed, in writing, to be complete by the Contractor. The cost of additional site visits by the Landscape Architect to verify completion of work shall be paid for by the Contractor.

3.10 MAINTENANCE:

A. Contractor shall furnish all labor, material, equipment, and services required to maintain the landscape in a healthy and attractive condition for a period of 60 days.

B. Maintenance shall include fertilization, watering, insect and disease control, weed control, weekly trash removal, mulching, restaking trees, tightening of guys, resetting plants to proper grades or upright position, and restoration of watering basins.

C. Maintenance of grass areas shall consist of fertilizing, watering, weeding, mowing, repair of all erosion, and reseeding as necessary to establish a uniform stand of the specified grasses. Areas and parts of areas which fail to show a uniform stand of grass for any reason shall be (reseeded or) resodded until all areas are covered with a satisfactory stand of grass. (Mulch reseeded areas with 1/4 in. of specified peat moss).

D. Maintenance period shall not start until all elements of construction, planting, and irrigation for the entire project are complete. Project will not be segmented into maintenance phases, unless specifically authorized in writing by the Owner's authorized representative.

E. The Contractor shall request an inspection to begin the plant maintenance period after all planting and related work has been completed in accordance with the Contract documents. A prime requirement is that all groundcover and lawn areas be planted. If such criteria is met to the satisfaction of the Architect, a field notification will be issued to the Contractor to establish the effective beginning date of the period.

F. The Contractor's maintenance period will be extended if the provisions required within the plans and specifications are not filled.

G. Watering:

1. All plants shall be kept watered as often as it is necessary to keep them in optimum, vigorous growth. The lawn shall, at no time, show a lack of fresh green color or a loss of resilience due to lack of water. Watering shall be done preferably during the early morning hours.

2. Water shall be controlled so that there will be no excessive run-off, ponding, or overwatering.

3. Root Growth: Periodically the Contractor shall check the progress of the root growth within the back fill area. As the root growth increases beyond the root ball, the frequency of watering shall be reduced so that the roots are encouraged to grow to a lower soil depth. Watering then shall be less frequent, but applications shall be very slow and the Contractor shall assure himself that water does penetrate to the depth of the former plant pit.

H. Spraying:

1. All shrubs and trees shall be inspected at least twice a month during the growing period to determine the need for spraying to control insect damage, fungus development or any other disease that might be attacking the plants. Preventative spraying shall be done only with the approval of the Landscape Architect.

2. Operators of spray equipment shall take all reasonable precautions to protect themselves, other people and buildings from spray. The Contractor shall have all permits and licenses required for such an operation. Where applicable, dormant spray shall be applied to shrubs and trees during the winter period.

3. All equipment shall be properly washed before and after use.

4. No spraying shall take place during windy or gusty days.

I. Staking and Guying: Stakes and guys shall be inspected a minimum of two times a month to assure that the wires and ties are tight and no damage has occurred to the tree trunk or branches.

J. Weed Control:

1. Weeds shall be kept under control, either by hand or by the application of herbicides designed for use on any type of weeds invading the planting areas.

2. All equipment used for herbicides shall be properly cleaned before it is used on this project. Herbicides shall be applied at temperatures recommended by the manufacturers. Herbicides shall not be used during windy or gusty days. All possible precautions shall be taken to protect vegetation which is susceptible to damage from the particular herbicides to be used.

3. The bases of all plants shall be kept completely free of weeds. Periodically, the base of the trees and shrubs shall be cultivated in order to allow better penetration of water, but such cultivation shall be carefully done in order not to destroy surface roots.

K. Fertilization: Top dress all areas at 45 day intervals from time of planting with fertilizer of same composition and at same rate as at time of planting.

L. Mowing:

1. All mowing shall be done in a neat and orderly manner. Equipment shall be moved onto and off the area to be mowed in such a manner that it will not leave

tracks or marks that detract from the finish turf. Timber shall be provided to move equipment over curbs, stairs, or similar constructions.

2. Mowing equipment shall be kept in optimum operating condition. The equipment shall be washed before initial use on the project so that there will be no chance of introducing foreign seeds or diseases onto the project.

3. Frequency of mowing shall be determined by the rate of growth of the grass. During seasons of peak growth mowing may have to be done every five days to six days; under normal conditions once a week should be adequate.

4. The average mowing height shall be 1-1/2". The grass blades must be cut sharply and cleanly. The turf must be cut evenly so that no ridges remain in the finish cut. The direction of mowing shall be alternated each time.

M. Litter: The Contractor shall remove promptly after pruning, trimming, and weeding or other work required under the contract, all debris generated by his performance of the work. Immediately after working in the areas of public walks, driveways or paved areas, they shall be vacuumed clean with suitable equipment. All areas covered by this contract shall be kept free of the following items: bottles, cans, paper cardboard or metallic items. Common debris and litter shall be disposed of in an appropriate manner.

N. Pruning: Prune as necessary to remove injured twigs and branches, dead wood, and suckers.

3.11 GUARANTEE AND REPLACEMENT:

A. Guarantee period shall be extended for a period of one year from the date of written acceptance.

B. All plants shall be guaranteed to be alive and healthy as determined by the Landscape Architect at the end of the guarantee period.

C. Plant materials supplied by Owner shall be under similar warranty against defective workmanship during the planting operations. Plant material exhibiting conditions which are determined by the Landscape Architect as being unacceptable, due to workmanship by the Contractor, shall be replaced at no additional cost to the Owner.

D. The Contractor shall replace, in accordance with the Drawings and Specifications throughout the guarantee period, any plants that die, or in opinion of the Landscape Architect, are in an unhealthy or unsightly condition, and or have lost their natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or any other causes due to the Contractor's negligence. The Contractor shall not be held responsible for acts of vandalism occurring after the beginning of the guarantee period.

END OF SECTION 02900

SECTION 02910

HYDROSEEDING

PART 1 – GENERAL

1.01 SCOPE:

A. Furnish and place hydroseeding and related work, including fertilizer, organic materials, seed fiber, stabilizing emulsion and all other materials shown on drawings and as specified herein.

1.02 QUALITY CONTROL:

A. Reviews: The Contractor shall specifically request a review by Landscape Architect of finish grade to receive hydroseeding, and site inspection of seed, fiber and fertilizer, prior to starting work Certificates shall be submitted to Landscape Architect prior to review; see following.

B. Nomenclature: Plant botanical names conform to "Standardized Plant Names", second edition.

C. Schedule: Hydroseeding schedule shall be submitted to the Owner within fourteen (14) days of the signed contract.

D. Hydroseeding limits: Shall be confirmed with the Landscape Architect prior to seeding.

1.03 SUBMITTALS:

A. Hydroseed Work Sheets:

Prior to the slurry preparation the operator shall supply the Owner a worksheet and checklist showing the amount of materials to be added to each dump of the seeder and the number of dumps needed to complete this job with the seeder size to be used.

B. Prior to hydroseeding, the Contractor shall submit a one ounce sample of the certified seed mix and bill of lading for materials.

C. Certification:

1. Seed: Contractor shall furnish the Landscape Architect with seed supplier's certificate guaranteeing statement of composition, mixture and percentage or purity or germination of each variety, weight and origin for all seed within five days after award of contract.

2. Fiber: Cellulose Fiber for hydroseeding shall be certified for laboratory and field testing of the product and that the product meets and has been tested for all requirements specified herein. Weight of fiber material specified and shipped shall refer only to air dry weight, containing not more than 10 percent (by weight) water.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. Seed shall be of commercial quality and certified by the California Crop Improvement Association. Grass seed shall be fresh, clean, new crop seed having a minimum purity of 98.5% and a minimum germination rate of 83%.

1. Seed shall be pre-mixed and packaged by a commercial seed supplier, tagged and labeled in accordance with California Agricultural Code.

2. Inert matter shall not exceed 5.0% nor weed content 0.5%, with no noxious weeds.

3. Seed shall be certified composed of the mix per plans.

B. Fertilizer:

1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade mark and conformance to State law.

2. Fertilizer shall be a granular type mixed by a commercial fertilizer house with the following chemical analysis by weight:

C. Stabilizing Agent (soil binder): Stabilizer shall be a biodegradable tacifier, non-toxic to plant or animal life, such as sentinel or M-binder.

D. Cellulose Fiber: Fiber shall be colored with a non-toxic, water soluble green dye to provide the proper visual gauge for metering of material over ground surfaces and shall be produced from natural or recycled (pulp) fiber, such as wood chips, similar wood materials, or newsprint, chip board, corrugated cardboard, or a combination of these processed materials.

1. Fiber shall be of such a character that upon addition and agitation in slurry tanks with fertilizer, seed, water and other additives, fibers become uniformly suspended to form a homogeneous slurry.

2. When hydraulically sprayed on the ground, fiber shall form a blotter-like groundcover impregnated uniformly with seed which allows absorption of moisture and rainfall percolation into underlying soil.

3. Materials that inhibit germination or growth shall not be present in the mixture.

E. Water: Shall be potable and furnished by Owner. Contractor to transport as required.

2.02 EQUIPMENT:

A. Equipment for the application of seed fertilizer, mulch and soil binder, shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of fiber mulch, seed, fertilizer, soil binder and water. The discharge system shall provide continuous, even distribution of the slurry on the slope surface to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons when operating.

B. Equipment for irrigation shall be available if deemed necessary for establishment of hydroseed.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS:

A. Prior to all work in this section, verify grades and carefully inspect the installed work of all other trades. The Contractor shall verify that hydroseed areas are adequately graded for seed application and free of deleterious material and weeds and complete to the point where the installation may properly commence. In the event of discrepancy, immediately notify the Landscape Architect. Do not proceed with this installation in areas of discrepancies until all such discrepancies have been fully resolved.

B. Install trees, shrubs and groundcover to be planted in hydroseeded area, prior to hydroseeding.

C. The Contractor shall obtain approval of hydroseed area preparation from the Landscape Architect prior to application.

3.02 APPLICATION OF HYDROSEED:

A. The hydroseed erosion control materials shall be mixed and applied in the following proportions to all areas indicated on the Drawings:

Seed mix per plan	
Cellulose Fiber	1800 lbs./acre
Fertilizer	350 lbs./acre
R/Binder	60 lbs./acre
Stabilizing Agent Water	as needed

B. Mixing: Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

C. Application:

1. Timing:

a. Irrigated hydroseed shall be applied between February 15th and October 15th.

b. Non-irrigated hydroseed shall be applied between October 15th and December 30th.

c. Hydroseed materials shall not be applied during windy or rainy weather or when soil temperatures are below 40 degrees F.

2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a sweeping motion to form a uniform mat at specified rate.

3. Keep hydromulch within areas designated and keep from contact with other plant materials.

4. Slurry mixture which has not been applied within 4 hours of mixing shall not be used and shall be removed from the site.

5. After application, the Contractor shall not operate any equipment or allow pedestrians in the covered area.

6. Daily worksheets shall be filled out by the nozzleman, with the following information: Seed type and amount, fertilizer analysis and amount, mulch type and amount, seeding additive type and amount, number of loads and amount of water, area covered and equipment used, capacity and license number.

3.03 MAINTENANCE:

A. Any area which has not produced a healthy, established stand of grasses after a period of 30 days from the date of seeding shall be reseeded and refertilized at the original rates of application. The Contractor shall be responsible for all seeded areas until an acceptable stand of hydroseed material has been achieved.

B. Fertilization:

The Contractor shall monitor the health of the hydroseed based on grass color. When grass shows signs of yellowing, or at 45 days following application the Contractor shall fertilize hydroseeded areas with a commercial blend fertilizer of 12N-12P-12K formulation at a rate of 6 lbs./100 square feet. (The above formula and rate may be adjusted as needed to conform to actual grass condition based on an assessment by the project horticulturist).

3.04 CLEAN-UP: Immediately after application thoroughly wash off any plant material, planting areas, paved areas, or architectural features not intended to receive slurry mix. Keep all areas of work clean, neat and orderly at all times. Keep all paved and planting areas clean during planting

and maintenance operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance or the satisfaction of the Landscape Architect.

3.05 INSPECTIONS:

A. Make written request for inspection prior to seeding and after areas have been seeded and planting operation completed.

B. Submit requests for inspections to Landscape Architect at least 72 hours prior to anticipated inspection date.

END OF SECTION 02910

SECTION 02920

LANDSCAPE SOIL PREPARATION

PART 1 – GENERAL

1.01 SCOPE

A. Furnish and install all landscape soil preparation as shown and specified including but not necessarily limited to, the following: topsoil placement, organic amendment and fertilizer placement, and finish grading.

B. Related work specified elsewhere.

1. Planting – Section 02950
2. Hydroseed – Section 02910

1.02 QUALITY CONTROL

A. Reviews: Contractor shall specifically request at least two days in advance the following reviews prior to progressing with the work:

1. Verification of amendment incorporation depths
2. Finish grade

B. Certification: Written certificates stating quantity, type, and composition, weight and origin for all amendments; chemicals shall be delivered to the Resident Engineer before the material is used on the site.

C. Test Samples: Contractor shall provide two (2) one-quart samples to Soil and Plant Laboratory of Santa Clara (408) 727-0330 for their testing for conformance to this specification. Sample one shall be the proposed import topsoil and sample two shall be from below existing paving. No material shall be delivered to the site until the Resident Engineer approves the material. Testing costs shall be paid by Contractor. Testing costs for the initial samples and costs for any additional samples due to non-compliance by the Contractor shall be paid by the Contractor.

D. Amendment Testing: Contractor shall provide a one-quart sample of each proposed amendment to Soil and Plant Laboratory of Santa Clara (408) 727-0330 for their testing for conformance to this specification. No material shall be delivered to the site until the Resident Engineer approves the material. Testing costs shall be paid by the Contractor.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Import Topsoil: Shall be a homogeneous mineral soil classified as sandy loam, or fine sand. Particle size data shall be based upon standard USDA methodology. Of the material falling in the sand category, a minimum of 80% shall fall in the fine sand range (.05 – 5mm). Gravel content (greater than 2.0mm) shall be less than 15%. Import topsoil shall not contain more silt and clay than the on-site native soil. The sum of silt plus clay shall be less than 25%, the soil shall be nonsaline as determined on the saturation extract. Alinity shall not exceed 3.0 mmhos/cm, boron shall not exceed 1.0 ppm and the sodium absorption ration (SAR) shall not exceed 6.0. Soil reaction as determined on a saturated paste shall fall between 5.5 and 7.5. The soil shall be free of organic herbicides, or other growth restricting chemicals. Contamination may be tested by greenhouse trials using rye grass and radish as test crops using the existing import soil as substrate. These trails require four to five weeks for completion.

B. Fertilizer: Shall be determined from soils analysis results. For purposes of bidding only, assume the use of 6-20-20 commercial fertilizer, 20-10-5 planting tablets by Agriform International Chemicals, Inc., and iron sulfate.

C. Organic Amendment: Nitrogen-treated organic amendment conforming to:

Physical Properties:	95%-100% passing, sieve size 6.35mm ¼", 80%-100% passing, sieve size 2.38mm No. 8, 8 mesh and 0%-30% passing, sieve size 500 micron No. 35, 32 mesh.
Chemical Properties:	Nitrogen Content dry weight basis – 0.4-0.6% iron content – minimum 0.08% dilute acid soluble Fe on dry weight basis, soluble salts – maximum 3.5 millimhos/ centimeter @ 25 degrees C. as determined by saturation extract method; ash – 0-6.0%.

PART 3 – EXECUTION

3.01 LIMITS AND GRADES

A. Prior to commencing soil preparation operations, Contractor shall request a review by the Resident Engineer to verify specified limits and grades of work completed to date and soil preparation work to commence. Contractor shall complete the rough grading as necessary to round the top and toe of all slopes, providing naturalized contouring to integrate newly graded areas with the natural topography. Finish grading under this

section shall be completed in accordance with the section shown on the landscape drawings.

3.02 TOPSOIL PLACEMENT

A. Cross rip topsoil to a depth of ten inches. Then incorporate the amendments to a homogeneously blended soil depth of six inches. Compact all soil in place to 85% compaction.

3.03 ORGANIC AMENDMENT AND FERTILIZER INCORPORATION

A. Materials determined from the soils test should be uniformly distributed throughout all irrigated planting areas and incorporated to a homogeneously blended soil depth of six inches. For bidding purposes, assume per 1000 square feet:

30 pounds Commercial Fertilizer (6-20-20)
5 cubic yards Nitrogen Stabilized Organic Amendment
10 pounds Ammonium Sulfate

3.04 TREE AND PLANT PITS

A. Tree pits shall have their sides and bottoms loosened or otherwise broken to prevent glazed or compacted surfaces. Contractor shall auger for each tree a minimum of three 18" diameter holes as appropriate for trees size and as shown on the planting notes and detail.

B. Plant pits shall have their sides and bottoms loosened or otherwise broken to prevent glazed or compacted surfaces, and shall be as shown on the planting detail.

3.05 BACKFILL

A. Backfill for plant pits shall be the prepared soil per parts 3.2 of this section, taken from adjacent prepared areas. Spread excavated material onto adjacent areas as replacement. Only unamended soil shall be used beneath the root ball; cultivate bottom of plant pit to improve porosity. Should additional backfill be necessary, a mixture of one-third organic amendment/fertilizer mix (per Soil and Plant Laboratory) and two-thirds topsoil may be used.

3.06 PLANT TABLETS

A. All container plants shall receive plant tablets as follows:

One-gallon plants	two 21-gram tablets
Five-gallon plants	five 21-gram tablets
Fifteen-gallon plants	twelve 21-gram tablets
Box trees	eighteen 21-gram tablets

Space the tablets evenly around the root ball halfway up backfill touching side of root ball. The Resident Engineer may require excavation of plants selected at random for conformance review.

3.07 FINISH GRADING

A. Contractor shall finish grade all irrigated planting areas unless otherwise noted, and shall remove all rocks and clods over one and one-half cubic inches. All areas shall be smooth and uniformly graded. All erosion damage during the construction period shall be repaired by the Contractor.

B. Unless otherwise noted, all soil finish grades shall be one inch below finish grade of walks, pavements and curbs.

END OF SECTION 02920

SECTION 03340

SITE CONCRETE WORK

PART 1 - GENERAL

1.01 SCOPE:

A. Provide concrete walks, vehicular paving, driveways, curbs, gutters, handicap ramps, flagstone paving and precast monoliths, complete and in place, as shown and specified. The work includes but is not limited to:

1. Final subgrade preparation and paving base
2. Concrete curbs, walks, paving, walls, driveways, roadway.
3. Flagstone paving, including grout joints.
4. Concrete footings for site mechanical, carpentry, and electrical items as shown.

1.02 RELATED DOCUMENTS:

A. The General Conditions of the Contract, including General and Special Provisions and General Requirements apply to the work in this section.

B. Related Work:

1. Section 02200: Earthwork
2. Section 02110: Clearing, Grubbing and Demolition
3. Section 02810: Irrigation System

1.03 QUALITY ASSURANCE:

A. Materials and methods of construction shall comply with the following standards:

1. American Society of Testing and Materials, (ASTM).
2. American Concrete Institute, (ACI).
3. Contra Costa County Standard Specification, Section 73.
4. State Standard Specifications, California Department of Transportation.
5. American National Standards Institute, (ANSI).
6. Bay Area Air Quality Management District, Sandblasting Guidelines.

B. Maintain field records of time, date of placing, curing and removal of forms of concrete in each portion of work.

C. Samples:

1. Sample panel: Before ordering material for concrete and flagstone paving work, provide sample panel, minimum 2' x 2' of each color and finish, using specified materials. Show color, texture, pattern, edging, and joint treatments.

a. Where applicable, the approved sample panel may be a portion of the work and remain in place. Location as directed by the Landscape

Architect. Contractor will be required to provide additional panels as necessary, until approved.

1.04 SUBMITTALS

A. Submit concrete mix designs to City. Obtain approval before placing concrete.

B. Product data:

1. Submit complete materials list of items proposed for the work. Identify materials source.

2. Submit admixture, curing compound, retarder, and accessory item product data, if used.

3. Submit material certificates for aggregates, reinforcing, and joint fillers.

4. Submit samples of flagstone and grout color to be used.

C. Submit concrete delivery tickets. Show the following:

1. Batch number.
2. Mix by class or sack content with maximum size aggregate.
3. Admixtures.
4. Slump.
5. Time of loading.

D. Submit concrete test reports.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Work notification: Notify City Public Works at least 24 hours prior to installation of concrete.

B. Establish and maintain required lines and grade elevations. All concrete shall slope to drain with no ponding of water.

C. Do not install concrete work over wet, saturated, muddy, or frozen subgrade.

D. Do not install concrete when air temperature is below 40 degrees F. Use of calcium chloride, salt, or any other admixture to prevent concrete from freezing is prohibited.

E. Protect adjacent work.

F. Provide temporary barricades and warning lights as required for protection of project work and public safety.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type 1, natural color, unless otherwise noted.

B. Aggregate: Provide ASTM C33 normal weight aggregates, 3/4" maximum size, clean, uncoated crushed stone or gravel coarse aggregate free of materials which cause staining or rust spots; fine aggregate shall be clean natural sand.

C. Water: Clean, fresh, and potable.

D. Water-reducing admixture: ASTM C494.

E. Bouquet Canyon Flagstone: To match existing City of San Ramon soundwalls. Submit samples for review.

F. Latex Portland Cement Grout: ANSI A108.10. Color of grout to blend with flagstone. Submit sample for review.

G. Concrete Admixtures and Color Additives: Custom color by L.M. Scofield, as approved by the Landscape Architect.

2.02 MIXES:

A. Provide Class A ready-mixed concrete. Batch mixing at site not acceptable.

1. For roadway paving: Use Portland Cement Concrete containing not less than 658 pounds of Portland Cement per cubic yard to allow for 7 day cure time, with a compressive strength of not less than 4000 p.s.i.

2. For all other site concrete: Use Portland Cement Concrete containing not less than 564 pounds of Portland Cement per cubic yard, with a compressive strength of not less than 3000 p.s.i.

B. Indicate water added to mix at job site on each delivery ticket. Show quantity of water added. Site water tempered mixes exceeding specified slump range will be rejected as not complying with specification requirements.

C. Color for roadway paving shall be : "Ginger", by Q.C. Products, or approved equal, available at (800) 918-3796.

2.03 ACCESSORIES:

A. Granular base: Class II Aggregate Base.

B. Forms: Wood or metal of sufficient strength to resist concrete placement pressure and to maintain horizontal and vertical alignment during concrete placement. Provide forms straight, free of defects and distortion, and height equal to full depth of concrete work.

1. Provide 2" nominal thickness, surfaced plank wood forms for straight sections. Use flexible metal, 1" lumber or plywood forms to form radius bends.

C. Joint Filler: ASTM D1751, premolded non-extruding asphalt-impregnated fiberboard, thickness indicated.

D. Curing compound: ASTM C309, non-yellowing, non-staining liquid membrane-forming type containing a fugitive dye. Chlorinated rubber compounds not acceptable for exterior use.

E. Joint Sealants: Two-components polysulfide or polyurethane elastromeric type complying with FS TT-S-00227, self-leveling, designed for foot traffic.

F. Reinforcing steel: ASTM A615, A616, or A617, Grade 60, new domestic deformed steel bars.

G. Welded wire fabric: ASTM A185, welded plain cold-drawn steel wire fabric as indicated.

H. Form release agent: Non-staining chemical form release agent free of oils, waxes, and other materials harmful to concrete.

I. Provide all stirrups, ties, anchors, shown or required to be cast into precast members.

J. Bolts, Nuts, and Washers: ASTM A307. Provide hot-dip galvanized fasteners for exterior use. Paint to match adjacent metal work.

K. Waterproofing at walls - Sonneborn HLM-5000, Tremco TP-60, Vulken 201, or approved equal.

L. Foam Fill for (2) monoliths - EPS Foam, by Foam Products, or equal.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

3.02 PREPARATION:

A. Proof roll the subgrade and do all necessary rolling and compacting to obtain firm, even subgrade surface. Fill and consolidate depressed areas. Remove uncompactable materials, replace with clean fill and compact to 90% of the maximum dry density in accordance with ASTM D1557-70.

B. Provide minimum 3" depth of compacted base material at walks. Compact base to 95% of the maximum dry density in accordance with ASTM D1557-70.

C. Remove loose material and debris from base surface before placing concrete.

D. Install, align, and level forms. Stake and brace forms in place. Maintain following grade and alignment tolerances:

1. Top of form: Maximum 1/8" in 10'-0".
2. Vertical face: Maximum ½" in 10'-0".

E. Coat form surfaces in contact with concrete with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage.

F. Install, set, and build-in work furnished under other specification sections. Provide adequate notification for installation of necessary items.

G. Install pipe sleeves for irrigation system furnished under Section 02810. Stake location of irrigation sleeves.

3.03 PLACING REINFORCEMENT:

A. Place all reinforcement as shown on the drawings. Place accurately and securely fasten and support reinforcement to prevent displacement before or during pouring. Hang footing bars from forms. Support wire mesh with suitable metal cradles.

B. Clean, bend and place reinforcement in accordance with current requirements of the ACI Manual of Concrete Practice.

C. Reinforcement Splices:
Welded wire fabric - one mesh minimum.
Reinforcing bars - 24 bar diameter minimum, except as otherwise noted.

3.04 INSTALLATION:

A. Concrete placement:

1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as specified.

2. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing. In cold weather comply with ACI 306, "Recommended Practice for Cold Weather Concreting". In hot weather comply with ACI 305, "Recommended Practice for Hot Weather Concreting".

3. Moisten base to provide a uniform dampened condition at the time concrete is placed. Verify structures are at required finish elevation and alignment before placing concrete.

4. Place and spread concrete to the full depth of the forms. Use only square-end shovels or concrete rakes for hand-spreading and consolidating operations to prevent segregation of aggregate and dislocation of reinforcement.

5. Place concrete in a continuous operation between expansion joints. Provide construction joints where sections cannot be placed continuously.

6. Place concrete as indicated on the plans in one course, monolith construction, for the full width and depth of concrete work.

7. Strike-off and bull-float concrete after consolidating. Level ridges and fill voids. Check surface with a 10'-0" straightedge. Fill depressions and refloat repaired areas. Darby the concrete surface to provide a smooth level surface ready for finishing.

B. Joints:

1. Provide expansion joints using premolded joint filler at concrete work abutting curbs, walls, structures, walks, and other fixed objects.

   a. Locate expansion joints as indicated.

   b. Install joint fillers full-width and depth of joint. Recess top edge below finish grade for joint sealants.

   c. Provide joint fillers in single lengths for the full slab width, whenever possible. Fasten joint filler sections together when multiple lengths are required.

   d. Protect the top edge of the joint filler during concrete placement.

   e. Brooming. After the curing period, expansion joints shall be carefully cleaned and filled with approved joint sealant to just below adjacent paved surface in such a manner as to avoid spilling on paved surfaces or overflow from joint.

C. Finishes:

1. Broom Finish: Shall be obtained by drawing a stiff bristled broom across a floated finish. Direction of brooming to be perpendicular to direction of work or otherwise shown on drawings.

2. Sand Blast Finish:

   a. Perform in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.

   b. Depth of Cut: Use an abrasive grit of the proper type and gradation to expose the aggregate and surrounding matrix surfaces to match approved sample panel.

   c. Blast corners and edge patterns carefully, using backup boards, in order to maintain a uniform corner or edge line.

   d. Use same nozzle, nozzle pressure and blasting technique as used for sample panel.

e. Maintain control of abrasive grit and concrete dust in each area of blasting. Clean up an remove all expended abrasive grit, concrete dust, and debris at the end of each day of blasting operations.

D. Curing:

1. Cure concrete with a clear, non-staining liquid membrane-forming compound. Spray apply in accordance with manufacturer's recommended coverage rate. Apply curing compound immediately after completing surface finish.

3.05 TESTING:

A. Provide slump test on first load of concrete delivered each day and whenever requested due to changes in consistency or appearance of concrete.

3.06 FLAGSTONE PAVING:

A. Install flagstones directly onto wet concrete as detailed in plans.

B. Allow flagstones to set for a minimum of 48 hours before grouting. Force a maximum amount of grout into joints. Fill all gaps and skips. Finished grout shall be uniform in color, smooth and without voids, pin holes or low spots.

C. Joints shall be concave tooled joints. All joints shall be of a uniform width or uniform thickness to maintain proper coursing. Grout shall be tooled at approximately the same degree of hardness to achieve uniform color. Expansion joints with sealant shall be constructed as shown in the plans.

D. Point and fill all holes and cracks in exposed joints with fresh mortar. Tooling shall be done at the proper time to match existing color of mortar.

3.07 PROTECTION:

A. Protect concrete work from damage due to construction and vehicular traffic until Final acceptance. Exclude construction and vehicular traffic from concrete pavements for at least 14 days.

B. Protection: Protect precast concrete items from chipping, spalling, cracking, or other damage until the Work is accepted by the Owner.

3.08 CLEANING:

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from concrete operations.

B. Sweep concrete sidewalks and pavement, wash free of stains, discoloration, dirt, and other foreign material immediately prior to final acceptance.

END OF SECTION 03340