TRUCKEE TAHOE AIRPORT DISTRICT

CONTRACT DOCUMENTS

INCLUDING:

NOTICE TO CONTRACTORS, SPECIAL PROVISIONS, BID FORM and CONTRACT

(CONTRACT PLANS BOUND SEPARATELY)

For The Construction of the:

VEHICLE MAINTENANCE BUILDING ADDITION

County of Nevada, California

For Use With:
State Of California Department Of Transportation
Standard Specifications Dated 2010

PREBID MEETING: January 4, 2017 10:00am

BID OPENING: January 16, 2017 3:00pm

TRUCKEE TAHOE AIRPORT DISTRICT

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NOTICE TO CONTRACTORS

Notice is hereby given that sealed bids will be received by the General Manager of the Truckee Tahoe Airport District (District) for the **Vehicle Maintenance Building Addition**, at the Truckee Tahoe Airport Administration Building, 10356 Truckee Airport Road, Truckee, CA 96161 until **January 16, 2017 at 3:00 pm** at which time they will be publicly opened and read. Bids must be submitted on forms provided by the District. Contract Documents may be obtained on the District website www.truckeetahoeairport.com . Persons wishing to submit a bid shall register their name and contact information with the District. Bidders are solely responsible for ensuring they receive updates and addenda.

A pre-bid meeting is scheduled for January 4, 2017 at 10:00 am at the Administration Building. All Requests for Information (RFIs) shall be submitted via e-mail by January 10, 2017 at 3:00 pm to Bill Quesnel, District Engineer bquesnel@ltol.com

Each bid must be accompanied by a certified or cashier's check payable to the order of the Truckee Tahoe Airport District, or by a bid bond executed by a corporate surety authorized to do business in the State of California in the sum of not less than 10% of the total amount of the bid, as a guarantee that the bidder will enter into the proposed contract if it be awarded to that bidder. No specific bond format is required but an example bond form is available upon request.

Bid documents shall be enclosed in an envelope that shall be sealed and clearly labeled with the project title, name of bidder, and date and time of bid opening in order to guard against premature opening of the bid.

The bidder to whom the contract is awarded by the District shall execute a contract and furnish a surety bond in the amount of 100% of the contract price guaranteeing the faithful performance of the contract executed by a corporate surety authorized to do business in the State of California. An additional bond for 100% of the contract price shall be furnished to secure the payment of claims for labor and materials furnished for the work executed by a corporate surety authorized to do business in the State of California. Bonds shall be provided in the form required by the District.

All bids are to be compared on the basis of the sum of the items of work on the Bid Form.

The prime contractor for the work herein shall possess the following valid State of California license at the time of bid:

"B" - General Building or "C" - Specialty Contractor with a classification in a specialty pertaining to the work described in the contract, as determined by the District Engineer. In addition, any subcontractor to the prime contractor must have all appropriate State of California licenses.

Pursuant to Labor Code Section 1771.1(a), a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal (subject to the requirements of Section 4104 of the Public Contract Code), or engage in the performance of any contract for public work, as defined in Chapter 1 of Part 7 of Division 2 of the Labor Code, unless currently registered with the Department of Industrial Relations and qualified to perform public work pursuant to Section 1725.5. No contractor may submit a bid on a District project unless the contractor is registered with the Department of Industrial Relations as required by Labor Code Section 1725.5, except that on projects with federal funds involved an unregistered contractor may submit a bid but may not be awarded the contract until and unless registered. All subcontractors listed in a bid must also be registered with the Department of Industrial Relations, subject to the exception in Labor Code Section 1771.1(c)”

The District will review the DIR maintained list at http://www.dir.ca.gov/Public-Works/PublicWorks.html for contractor registration (Labor Code Sections 1725.5, 1771.1(b)). The District will notify DIR within five days of the award of contract electronically on a form provided by DIR. (Labor Code Section 1773.3)

The District reserves the right to retain all bids for a period of thirty (30) days for examination and comparison, and to delete any portion of the work from the contract. The District reserves the right to reject any and all bids and to waive any informality in such bids. The District shall award the Contract to the lowest responsive, responsible bidder. The lowest bid shall be the lowest total of the bid prices on the Bid Form; bids determined by the District to be unbalanced will be rejected.

Liability Insurance shall be acquired by contractor according to Section 7-1.01, "Insurance Policies" of the Special Provisions prior to starting work and contract execution by the District.

The successful bidder must fully comply with all applicable laws, rules and regulations in furnishing or using equipment and/or providing services and shall indemnify the District against any fines or penalties imposed by any governmental or regulatory agency for violations of applicable laws, rules and/or regulations by the successful bidder, its subcontractors, or others for whom the successful bidder is responsible under its indemnity obligations.

This project is subject to compliance monitoring and enforcement by the California Department of Industrial Relations.

The Truckee Tahoe Airport District hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

This project is subject to State of California prevailing wage. The Director of Industrial Relations has determined the general prevailing rate of per diem wages in the locality in which this work is to be performed for each craft or type of worker needed to execute the Contract which will be awarded to the successful bidder, copies of which are on file and will be made available to any interested party upon request at Department of Industrial Relations Labor Commissioner at 20131 Howe Avenue, Ste. 100, Sacramento, or online at http://www.dir.ca.gov/dlsr. A copy of these rates shall be posted by the successful bidder at the job site. The successful bidder and all subcontractor(s) under him, shall comply with all applicable Labor Code provisions, which include, but are not limited to the payment of not less than the required prevailing rates to all workers employed by them in the execution of the Contract, the employment of apprentices, the hours of labor and the debarment of contractors and subcontractors.

Pursuant to Public Contract Code Section 3400(c), if the District has made any findings designating certain materials, products, things, or services by specific brand or trade name, such findings and the materials, products, things, or services and their specific brand or trade names will be set forth in the Special Provisions.

Five percent (5%) will be deducted from each progress payment and retained by the District and the remainder, less the amount of all previous payments, will be paid to the Contractor. At the request and expense of the successful Bidder, the District will allow the substitution of securities for the amount so retained in accordance with Public Contract Code Section 22300.

For further information, contact Bill Quesnel, District Engineer, Truckee Tahoe Airport District, (530) 550-8068, bquesnel@ltol.com

REQUEST FOR BIDS

BID for Truckee Tahoe Airport District Vehicle Maintenance Building Addition

Pre-bid meeting on January 4, 2017 10:00 AM at District Administration Building, 10356 Truckee Airport Road, Truckee, CA.

All RFIs submitted via e-mail by January 10, 2017 at 3:00PM to Bill Quesnel, District Engineer, bquesnel@ltol.com

Bids to be received by January 16, 2017 at 3:00 PM at District Administration Building

Contract Award (planned) is January 25, 2017

Submittal of Structural Drawings and Calculations prepared by Building Supplier to District for submittal to regulatory agencies for issuance of Permits required by April 15, 2017

Estimated date of issuance of Notice to Proceed is 60 days after submittal of drawings

Building to be erected & weather-tite and all site work completed by October 15, 2017.

Building interior to be completed and Certificate of Occupancy issued by December 31, 2017

Liquidated Damages: $500.00 per Calendar Day past the December 31, 2017 deadline.

BID

BID for the Truckee Tahoe Airport Vehicle Maintenance Building Addition

Pursuant to the foregoing Notice To Contractors, the undersigned declares that s/he has carefully examined the location of the proposed work; that s/he has examined the plans, specifications, and special provisions and read the accompanying instructions to bidders and Notice to Contractors; and, hereby proposes to furnish all materials and to do all the work required to complete said work in accordance with said plans and specifications for the prices set forth in the following proposed schedule.

The bidder agrees to execute the required Construction Contract (See Attachment A) and provide the necessary insurance certificates and bonds within fourteen (14) calendar days after the contract is approved by Board of Directors.

Pre-construction submittals shall be submitted to the District after the contract is approved by Board of Directors and prior to the issuance of a Notice to Proceed.

The undersigned further agrees that in case of default in executing the required contract, with necessary bonds, within fourteen (14) calendar days after the contract is approved by the Board of Directors, the proceeds of the check or bond accompanying his or her bid shall become the property of the Truckee Tahoe Airport District.

If an individual, so state. If a firm or co-partnership, state the firm name and give the names of all individuals or co-partners composing the firm. If a corporation, state legal name or corporation, also names of President, Secretary, Treasurer, and Manager thereof.

BIDDER: _____

A/ AN: [INDIVIDUAL/ PARTNERSHIP/ CORPORATION/ ETC.] _____

STATE OF INCORPORATION: _____

CORPORATE OFFICERS: _____
_____
_____

BIDDER'S STATEMENT OF SUBCONTRACTORS & MATERIAL FABRICATORS

Each bid shall have listed therein the name and address of each subcontractor to whom the bidder proposes to subcontract portions of the work in an amount in excess of one-half of one percent of the total bid in accordance with the Subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code. The bidder's attention is invited to other provisions of the Act related to the imposition of penalties for a failure to observe these provisions by using unauthorized subcontractors or by making unauthorized substitutions.

The undersigned submits herewith a list of subcontractors and material fabricators whom he/she proposes to employ on the work with the proper firm name and business address of each.

Name Under Which Subcontractor is Licensed	License Number	License Type	DIR License	Location of Office, Mill or Shop	Portion of Work*

*Describe the portion of Work to be done by each listed subcontractor; list only one subcontractor for each portion. If more than one subcontractor will provide similar work, the description must distinguish the portion to be done by each subcontractor in such a manner that the District can determine that only one subcontractor is listed for each portion of the Work. The purpose of this clause is to prevent shopping of subcontractor bids after bid opening.

If no subcontractor is specified for a portion of the Work, or if more than one subcontractor is specified for the same portion of the Work, then the Contractor shall be deemed to have agreed that it is fully qualified to perform that Work, and that it shall perform that portion itself.

Bidder acknowledges and understands that, pursuant to Public Contract Code Section 20676, sellers of "mined material" must be on an approved list of sellers published pursuant to Public Resources Code Section 2717(b) in order to supply mined material for this Contract.

TECHNICAL ABILITY AND EXPERIENCE

The bidder is required to state what work of a similar character to that included in the proposed contract has been successfully performed and give references which will enable the District to judge his or her responsibility, experience, skill and business, and financial standing.

PROJECT	DATE COMPLETE	DESCRIPTION	REFERENCE

NONDEBARMENT AND CONTRACTOR'S LICENSE

In accordance with the provisions of the Labor Code, contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Section 1777.1 or Section 1777.7 of the Labor Code. Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid to a debarred subcontractor by the Contractor for the Work shall be returned to the District. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor used on the Work.

Contractor verifies that neither it nor any subcontractor listed in its bid is ineligible to perform work on a public project pursuant to Section 1777.1 or Section 1777.7 of the Labor Code.

Contractor further certifies that it is licensed in accordance with the law providing for the registration of Contractors, License No. _____, Expiration Date _____, Class of License _____.

The above Statement is part of the Bid.

TRUCKEE TAHOE AIRPORT DISTRICT
VEHICLE MAINTENANCE BUILDING ADDITION

Bid Item	***Description***	***Item Price***
1.01	*Bonds and Insurance, Mobilization, Security and Temporary Facilities*	
2.01	*Temporary Erosion Control*	
2.02	*Demolition*	
2.03	*Earthwork (excavation and structural fill) per Holdrege&Kull Geotechnical Engineer Report*	
2.04	*Asphalt Paving and extension of Concrete Valley Gutter*	
2.05	*Utility relocation and extension*	
3.01	*Concrete Footings and Slab*	
5.01	*Procurement of Metal Building*	
5.02	*Preparation of Building Drawings and Structural Calculations for permit submittal by Owner*	
5.03	*Building Erection including frame, roof, siding, flashing, trim, etc.*	
5.04	*Mezzanine structure including stairs, railing, gates and concrete filled deck pan*	
5.05	*Bollards at roll-up doors*	
6.01	*Plywood on building walls*	
7.01	*Roof insulation*	
7.02	*Siding insulation*	
7.03	*Seismic Joint*	
8.01	*Man Doors*	
8.02	*Roll-up Vehicle Bay Doors*	
8.03	*Roll-up Mezzanine and Storage Access Doors*	

Bid Item	***Description***	***Item Price***
8.04	*Roll-up door at existing north wall*	
8.05	*Windows in new north wall*	
9.01	*Painting to match existing finishes and plywood on walls*	
21.01	*Design of Fire Sprinkler and Alarm System for submittal to Building and Fire Officials*	
21.02	*Fire Sprinkler and Alarm System*	
22.01	*Domestic Water System*	
22.02	*Sanitary Waste System including floor drain*	
22.03	*Compressed Air System*	
23.01	*Heating System*	
23.02	*Exhaust and Ceiling Fan System*	
26.01	*Modify Panel E and extend power to addition*	
26.02	*Installation of Panels C and E2, grounding system, power distribution and receptacles*	
26.03	*Interior and Exterior Lighting and Controls*	
26.04	*Telco, video and fire alarm conduits and panels*	
$ TOTAL BID AMOUNT		

If the item price for a lump sum item is unreadable or otherwise unclear, or is omitted, the bid may be deemed irregular and rejected in its entirety.

TOTAL BID AMOUNT:

$ _____

Total Bid Amount in Numbers

_____

Total Bid Amount in Written Form

The lowest bid shall be the lowest sum of the bid item prices.

The undersigned agrees that this Bid Form constitutes a firm offer to the District which cannot be withdrawn for the number of calendar days indicated in the Notice Inviting Bids from and after the bid opening, or until a Contract for the Work is fully executed by the District and a third party, whichever is earlier.

CONFLICT OF INTEREST

The bidder's execution on the signature portion of this bid certifies that the contractor is in compliance with applicable state conflict of interest laws.

BIDDER'S STATEMENTS AND QUESTIONNAIRE

1. Public Contract Code Section 10285.1 Statement

In accordance with Public Contract Code Section 10285.1 (Chapter 376, Stats. 1985), the bidder hereby declares under penalty of perjury under the laws of the State of California that the bidder ____has, ____has not been convicted within the preceding three (3) years of any offenses referred to in that section, including any charge of fraud, bribery, collusion, conspiracy, or any other act in violation of any State or Federal antitrust law in connection with the bidding upon, award of, or performance of any public works contract, as defined in Public Contract Code Section 1101, with any public entity, as defined in Public Contract Code Section 1100, including the Regents of the University of California or the Trustees of the California State University. The term "bidder" is understood to include any partner, member, officer, director, responsible managing officer, or responsible managing employee thereof, as referred to in Section 10285.1.

Note:

The bidder must place a check mark before "has" or "has not" in one of the blank spaces provided. The above Statement is part of the Bid. Signing this Bid on the signature portion thereof shall also constitute signature of this Statement. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

2. Public Contract Code Section 10162 Questionnaire

In accordance with Public Contract Code Section 10162, the Bidder shall complete, under penalty of perjury, the following questionnaire:

Has the bidder, any officer of the bidder, or any employee of the bidder who has a proprietary interest in the bidder, ever been disqualified, removed, or otherwise prevented from bidding on, or completing a federal, state, or local government project because of a violation of law or a safety regulation?

Yes_____ No_____

If the answer is yes, explain the circumstances in the following space:

3. Public Contract Code 10232 Statement

In accordance with Public Contract Code Section 10232, the Contractor hereby states, under penalty of perjury, that no more than one (1) final unappealable finding of contempt of court by a federal court has been issued against the Contractor within the immediately preceding two (2) year period because of the Contractor's failure to comply with an order of a federal court which orders the Contractor to comply with an order of the National Labor Relations Board.

NOTES:
Providing false information may result in criminal prosecution or administrative sanctions. The above certification is part of the Bid. Signing this Bid on the signature portion thereof shall also constitute signature of these Certifications.

NONCOLLUSION DECLARATION
TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

The undersigned declares:

I am the _____ of _____, the party making the foregoing bid. The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid. The bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or to refrain from bidding. The bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder. All statements contained in the bid are true. The bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____[date], at _____[city], _____[state].

Execution of the Bid Signature Page shall constitute execution of this declaration. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

BID SIGNATURE PAGE

The work for which this bid is submitted is for construction in conformance with the special provisions, the project plans (including any addenda thereto), and the construction contract.

Truckee Tahoe Airport District Vehicle Maintenance Building Addition

CONTRACTOR:

Bidder Name:_____

Signature:_____

Name & Title:_____

Mailing Address: _____

City, State, Zip:_____

_____

Telephone Number:_____

Fax Number:_____

Email Address:_____

DIR License #: _____

Dated:_____

Addenda Included in the Bid

The following addenda have been reviewed and are included in the bid price and bid document by reference:

Addenda No. _____

Addenda No. _____

Addenda No. _____

BID BOND

TRUCKEE TAHOE AIRPORT DISTRICT

We, _____ as Principal, and _____ as Surety are bound unto the TRUCKEE TAHOE AIRPORT DISTRICT, hereafter referred to as "Obligee," in the penal sum of ten percent (10%) of the total amount of the bid of the Principal submitted to the Obligee for the work described below, for the payment of which sum we bind ourselves, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT: WHEREAS, the Principal is submitted to the Obligee, for VEHICLE MAINTENANCE BUILDING ADDITION: for which bids are to be opened at the District Administration Building at Truckee, California, on January 16, 2017:

NOW, THEREFORE, if the Principal does not withdraw its bid, and is awarded the contract and, within the time and manner required under the specifications, after the prescribed forms are presented to him for signature, enters into a written contract, in the prescribed form, in accordance with the bid, and provides all documents to the District as required by the Contract Document, including but not limited to two (2) bonds with the Obligee, one to guarantee faithful performance of the contract and the other to guarantee payment for labor and materials as provided by law, then this obligation shall be null and void; otherwise, it shall remain in full force.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Documents shall affect its obligation under this bond, and Surety does hereby waive notice of any such changes.

In the event suit is bought upon this bond by the Obligee and judgment is recovered, the Surety shall pay all costs incurred by the Obligee in such suit, including a reasonable attorney's fee to be fixed by the court.

IN WITNESS WHEREOF, the above-bound parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporation.

Dated: _____, 20___.

CORPORATE SEAL

_____

_____

_____

Principal

CORPORATE SEAL

_____

Surety

By: _____

Attorney-in-Fact

[ATTACH ATTORNEY-IN-FACT CERTIFICATE]

NOTE: Signatures must be properly acknowledged.

PAYMENT BOND

(Civil Code Section 9554)

TRUCKEE AIRPORT DISTRICT

WHEREAS, The Truckee Tahoe Airport District, hereafter referred to as "Obligee," has awarded to Contractor _____hereafter designated as the "Principal," a contract for the work described as follows:

VEHICLE MAINTENANCE BUILDING ADDITION

AND WHEREAS, said Principal is required to furnish a bond in connection with said contract, to secure the payment of claims of laborers, mechanics, materialmen, and other persons as provided by law.

NOW, THEREFORE, we the undersigned Principal and Surety are bound unto the Obligee in the sum of _____ Dollars ($_____) for which payment, we bind ourselves, jointly and severally.

THE CONDITION OF THIS OBLIGATION IS SUCH,

That if said Principal or any of its subcontractors shall fail to pay any of the persons named in Civil Code Section 9100, for any materials, provisions or other supplies, used in, upon, for or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or amounts due under Section 13202 of the Unemployment Insurance Code with respect to work or labor performed by such claimant, or any amounts required to be deducted, withheld, and paid over to the Employment Development Department or the Franchise Tax Board for the wages of employees of the Principal and his subcontractors pursuant to Section 18663 of the Revenue and Taxation Code, with respect to such work and labor, that the surety herein will pay for the same in an amount not exceeding the sum specified in this bond, otherwise the above obligation shall be void. In case suit is brought upon this bond, the surety will pay all litigation expenses incurred by the District in such suit, including reasonable attorneys' fees, court costs, expert witness fees and investigation expenses.

This bond shall inure to the benefit of any of the persons named in Civil Code Section 9100 as to give a right of action to such persons or heir assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety on this bond shall not be exonerated or released from the obligation of this bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described, or pertaining or relating to the furnishing of labor, materials, or equipment therefore, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement herein above described, nor by any rescission or attempted rescission or attempted rescission of the contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the owner or District and original contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Section 9100 of the Civil Code, and has not been paid

the full amount of his claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF, the above-bound parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporation.

Dated: _____, 20___

CORPORATE SEAL

_____
_____
_____
Principal

CORPORATE SEAL

_____
Surety
By: _____
Attorney-in-Fact
[ATTACH ATTORNEY-IN-FACT CERTIFICATE]

NOTE: Signatures of those executing for the surety must be properly acknowledged.

Correspondence or claims relating to this bond should be sent to the surety at the following address:

_____
_____
_____
_____

FAITHFUL PERFORMANCE BOND

TRUCKEE TAHOE AIRPORT DISTRICT

Bond No. _____

KNOW ALL MEN BY THESE PRESENTS:

WHEREAS, the TRUCKEE TAHOE AIRPORT DISTRICT ("District") has awarded to _____ _____ hereafter designated as the "Contractor", a contract for the work described as follows:

VEHICLE MAINTENANCE BUILDING ADDITION

The work to be performed by the Contractor is more particularly set forth in the Contract Documents for the Project dated _____, (hereinafter referred to as "Contract Documents"), the terms and conditions of which are expressly incorporated herein by reference; and

WHEREAS, the Contractor is required to furnish a bond in connection with said contract, guaranteeing the faithful performance thereof:

NOW, THEREFORE, we the undersigned Contractor and surety held and firmly bound unto the District, as obligee, in the sum of _____ Dollars ($_____ _____), said sum being not less than one hundred percent (100%) of the total amount of the Contract, to be paid to said District or its certain attorney, its successors, and assigns: for which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, successors, or assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH,

That if the above bound Contractor, his or its heirs, executors, administrators, successors, or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the foregoing contract and any alteration thereof made as therein provided, on his or their part to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning, and shall faithfully fulfill all obligations, and shall indemnify and save harmless the District, its officers and agents, as therein stipulated, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and virtue.

As a part of the obligation secured hereby and in addition to the face amount specified therefore, there shall be include District and reasonable expenses and fees including reasonable attorney's fees, incurred by the District in enforcing such obligation.

As a condition precedent to the satisfactory completion of the Contract Documents, unless otherwise provided for in the Contract Documents, Contractor's guarantee obligation shall hold good for a period of one (1) year after the acceptance of the work by the District, during which time if Contractor shall fail to make full, complete, and satisfactory repair and replacements and totally protect the District from loss or damage resulting from or caused by defective materials or faulty workmanship, the above obligation in penal sum thereof shall remain in full force and effect. The obligations of Surety hereunder shall continue so long as any obligation of Contractor remains. Nothing herein shall limit the District's rights or the Contractor's or Surety's obligations under the Contract, law or equity, including, but not limited to, California Code of Civil Procedure section 337.15.

Whenever Contractor shall be, and is declared by the District to be, in default under the Contract Documents, the Surety shall remedy the default pursuant to the Contract Documents, or shall promptly, at the District's option:

(1) Take over and complete the Project in accordance with all terms and conditions in the Contract Documents; or

(2) Obtain a bid or bids for completing the Project in accordance with all terms and conditions in the Contract Documents and upon determination by Surety of the lowest responsive and responsible bidder, arrange for a Contract between such bidder, the Surety and the District, and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the contract price, including other costs and damages for which Surety may be liable. The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor by the District under the Contract and any modification thereto, less any amount previously paid by the District to the Contractor and any other set offs pursuant to the Contract Documents.

(3) Permit the District to complete the Project in any manner consistent with California law and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the contract price, including other costs and damages for which Surety may be liable. The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor by the District under the Contract and any modification thereto, less any amount previously paid by the District to the Contractor and any other set offs pursuant to the Contract Documents.

Surety expressly agrees that the District may reject any contractor or subcontractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Contractor.

Surety shall not utilize Contractor in completing the Project nor shall Surety accept a bid from Contractor for completion of the Project if the District, when declaring the Contractor in default, notifies Surety of the District's objection to Contractor's further participation in the completion of the Project.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project to be performed thereunder shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project.

[SIGNATURES ON FOLLOWING PAGE]

IN WITNESS WHEREOF, the above-bound parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporation.

Dated: _____, 20___.

CORPORATE SEAL

_____

_____

_____

Principal

CORPORATE SEAL

_____

Surety

By: _____

Attorney-in-Fact

[ATTACH ATTORNEY-IN-FACT CERTIFICATE]

NOTE: Signatures of those executing for the surety must be properly acknowledged.

Correspondence or claims relating to this bond should be sent to the surety at the following address:

_____

_____

_____

_____

SPECIAL PROVISIONS
FOR THE
Construction of the
TRUCKEE RIVER LEGACY TRAIL GLENSHIRE TRAILHEAD
C1413

Town of Truckee, County of Nevada, California

SECTION 1. GENERAL

1-1.01 SPECIFICATIONS AND PLANS

The work embraced herein shall be done in accordance with the project Construction Plans and Specifications dated December 15, 2016 and the State of California Standard Specifications dated 2010, insofar as the same may apply and in accordance with the following Special Provisions.

In case of conflict between the Specifications and Plans, the following order of precedence is established in order of highest to lowest priority:

1. The project plans dated December 15, 2016:
    a. Architectural: Cover, A2.1, A3.1, A3.2
    b. Civil: C1, C2, C3
    c. Structural: S1.1, S2.1, S2.2, S3.1, S4.1
    d. Mechanical: M1.1, M2.1, M3.1, M4.1
    e. Electrical: E1.0, E1.1, E2.1
2. Holdrege&Kull Geotechnical Report 41377A-02 dated February 17, 2016
3. Title 24 Lighting Documents
4. Technical Specifications
5. The project Special Provisions
6. The State of California Standard Specifications

The following documents are available upon request to assist the Contractor in preparation of the bid:

1. Original WedgCor Building Plans: Cover, A1-A3, E1-E14, G1-G dated November 13, 1997
2. Sunward Proposal dated February 16, 2016
3. Sunward Preliminary Drawings dated March 28, 2016

The numbering of sections and subsections in these special provisions are compatible with the numbering in the State of California Standard Specifications.

1-1.02 DEFINITIONS AND TERMS

STATE – Truckee Tahoe Airport District or its designated officer or agent.

CITY – Truckee Tahoe Airport District or District

DEPARTMENT/DISTRICT/DEPARTMENT OF TRANSPORTATION – Truckee Tahoe Airport District except when referring to documents, laws or a department of the State of California.

DIRECTOR – General Manager, Truckee Tahoe Airport District.

ENGINEER – Truckee Tahoe Airport District Engineer or his designee acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

LABORATORY – The established laboratory of the Materials and Research Department of the Department of Transportation of the State of California or laboratories authorized by the Engineer to sample and test materials and work involved in the Contract except when referring to documents, laws or department of the State of California.

OWNER – Project proponent, Truckee Tahoe Airport District or District.

PLANS – The construction plans titled "Truckee Tahoe Airport Vehicle Maintenance Building Addition" dated December 15, 2016

STANDARD SPECIFICATIONS – The 2010 edition of the Standard Specifications of the State of California, Department of Transportation. Any reference therein to the State of California or a state agency, office, or officer shall be interpreted to refer to the Airport District or its corresponding agency, office, of officer acting under this contract.

ACCEPTANCE - The formal written acceptance by the Truckee Tahoe Airport District of the completed project.

ADDENDUM - The modification of the plans and/or specifications issued to all prospective bidders during the period when necessary to change, correct, clarify or further define any phase of the work.

DESIGN ENGINEER, SOILS ENGINEER, LANDSCAPE ARCHITECT - Advisors employed by the Town.

BIDDER - Any individual, firm, partnership, corporation, or combination thereof, submitting a bid for the work contemplated, acting directly or through a duly authorized representative.

DUE NOTICE - A written notification, given in due time, of a proposed action where such notification is required by the contract to be given a specified interval of time (usually 48 hours or two working days) prior to the commencement of the contemplated action. Notification may be from Engineer to Contractor or from Contractor to Engineer.

PROMPT - The briefest interval of time required for a considered reply, including time required for approval of a governing body.

1.1-03 AMENDMENTS TO 2010 STANDARD SPECIFICATIONS

Amendments to the Standard Specifications set forth in these special provisions shall be considered as part of the Standard Specifications for the purposes set forth in Section 5-1.02, "Contract Components," of the Standard Specifications. Whenever either the term "Standard Specifications is amended" or the term "Standard Specifications are amended" is used in the special provisions, the text or table following the term shall be considered an amendment to the Standard Specifications. In case of conflict between such amendments and the Standard Specifications, the amendments shall take precedence over and be used in lieu of the conflicting portions.

The amendments are found at the following link:

http://www.dot.ca.gov/hq/esc/oe/construction_standards.html

SECTION 2. BIDDING

2-1.01 GENERAL

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

2-1.02 EXAMINATION OF PLANS, SPECIFICATIONS, CONTRACT, AND SITE WORK

The bidder shall examine carefully the bid, plans, specifications, and all contract documents. Bidders are urged to visit the site of the work and by their own investigation satisfy themselves as to the existing conditions affecting the work to be completed as part of this project. If the bidder chooses not to visit the site or conduct investigations, s/he will nevertheless be charged with knowledge of conditions which reasonable inspection and investigation would have disclosed.

2-1.03 ADDENDA

The District reserves the right to revise the Contract Documents prior to the bid opening date. Revisions, if any, shall be made by written Addenda. All addenda issued by the District shall be included in the bid and made part of the Contract Documents. Pursuant to Public Contract Code Section 4104.5, if the District issues an Addendum which includes material changes to the Project less than 72 hours prior to the deadline for submission of bids, the District will extend the deadline for submission of bids. The District may determine, in its sole discretion, whether an Addendum warrants postponement of the bid submission date. Each prospective bidder shall provide the District a name, address and email address or facsimile number to which Addenda may be sent, as well as a telephone number by which the District can contact the bidder. Copies of Addenda will be furnished by email, facsimile or other proper means of delivery without charge to all parties who have obtained a copy of the Contract Documents and provided current contact information. Please Note: Bidders are responsible for ensuring that they have received any and all Addenda. To this end, each bidder should contact the District Engineer to verify that he has received all Addenda issued, if any, prior to the bid opening.

2-1.04 DELETED

Section 2-1.12 “Disadvantaged Business Enterprises” of the Standard Specifications is deleted.

Section 2-1.15 “Disabled Veteran Business Enterprises” is deleted.

Section 2-1.27 “California Companies” is deleted.

Section 2-1.50 “Bid Rigging” is deleted.

SECTION 3. AWARD AND EXECUTION OF CONTRACT

3-1.01 AWARD

The District shall award the Contract to the lowest responsive, responsible Bidder submitting a responsive Bid. The District may reject any Bid which, in its opinion when compared to other bids received or to the District's internal estimates, does not accurately reflect the cost to perform the work. The District may reject as non-responsive any bid which unevenly weights or allocates costs, including but not limited to overhead and profit to one or more particular bid items.

3-1.02 NOTICE OF AWARD

Once all Bids are opened and reviewed to determine the lowest responsive and responsible Bidder, the District Board of Directors may award the contract. The apparent successful Bidder should begin to prepare the following documents: (1) the Performance Bond; (2) the Payment (Labor and Materials) Bond; and (3) the required insurance certificates and endorsements. Once the District notifies the Bidder of the award, the Bidder will have fourteen (14) calendar days from the date of this notification to execute the Contract and supply the District with all of the required documents and certifications.

3-1.03 FORFEITURE OF BID SECURITY

If its bid shall be accepted and the bidder shall fail to enter into the contract and furnish all documents required by the Contract Documents, including the two (2) bonds and evidence of insurance, with surety satisfactory to the Town within fourteen (14) calendar days, the District may, at its option, determine that the bidder has abandoned the contract, and thereupon this bid and the acceptance thereof shall be null and void and the forfeiture of the security accompanying this bid shall operate and the same shall be the property of the District. In such instance, the District shall be authorized at its sole discretion to award the contract to the next low bidder, or to reject all bids and rebid the project at its option.

3-1.04 PERMITS AND LICENSES

A Nevada County building permit is required for construction of the building addition. The Contractor is required to submit plans, structural calculations and all supporting documents to the District for submittal to Nevada County for review and issuance of the Building Permit. The District will pay the plan check and permit fees, the contractor is responsible for pulling the permit and coordinating all required inspections through Certificate of Occupancy.

Contractor shall comply with the requirements of the Northern Sierra Air Quality Management District Dust Control requirements and the Dust Control notes on Page C1 of the plans.

3-1.05 DISPOSAL OF MATERIAL

All material generated by the Contractor shall become the property of the Contractor, except as specified in the plans or special provisions. If the contractor elects to store equipment and/or materials outside the right-of-way, the contractor shall provide the District with a written copy of the agreement(s) allowing use of private property.

3-1.06 CONTRACTOR LICENSE

The Contractor must be properly licensed as a contractor from bid opening through Contract acceptance (Bus & Prof Code § 7028.15). Contractor shall also provide proof of current valid contractor license with each pay request.

3-1.07 CONTRACT EXECUTION

Section 3-1.18 “Contract Execution” of the Standard Specifications is deleted. The form of contract shall be as set forth in Attachment A to these Special Provisions.

3-1.08 DELETED

Section 3-1.08 “Small Business Participation Report” of the Standard Specifications is deleted.

Section 3-1.11 “Payee Data Record” of the Standard Specifications is deleted.

Section 3-1-12 “Caltrans Bidder – DBE Information Form” of the Standard Specifications is deleted.

SECTION 4. SCOPE OF WORK

4-1.01 TIME OF COMPLETION

Completion of the building addition and Nevada County issuance of a Certificate of Occupancy shall occur not later than December 31, 2017 assuming the following schedule:

Contract Award: **January 25, 2017 Board Meeting**

Notice of Award: **February 1, 2017**

Submittal of Structural Drawings and Calculations prepared by Building Supplier to District for submittal to Nevada County and regulatory agencies for issuance of Permits: **April 15, 2017**

Notice to Proceed: **60 days** after submittal of drawings to Owner and issuance of Permits

Building erected & weather-tite and all site work complete: **October 15, 2017**

Building interior completed and Certificate of Occupancy issued: **December 31, 2017**

Liquidated Damages: $500.00 per Calendar Day past the December 31, 2017 deadline.

Hours of Work: The contractor may work Monday through Saturday, 7:00am to 7:00pm unless otherwise restricted by Nevada County. No work shall occur on Sundays or Federal/State Holidays.

4-1.02 VALUE ENGINEERING

Attention is directed to Section 4-1.07, "Value Engineering," of the Standard Specifications.

Prior to preparing a written Value Engineering Change Proposal, the Contractor shall request a meeting with the District to discuss the proposal in concept. Items of discussion will also include permit issues, impact on other projects, impact on the project schedule, peer reviews, overall merit of the proposal, and review times required by the District and other agencies.

If a Value Engineering Change Proposal submitted by the Contractor, and subsequently approved by the Engineer, provides at least a 10 percent reduction in the cost of the project, 60 percent of the estimated net savings in construction costs attributable to the cost reduction proposal will be paid to the Contractor.

SECTION 5. CONTROL OF WORK

5-1.01 ORDER OF WORK

Order of work shall conform to the applicable provisions of the Standard Specifications and these special provisions.

Installation of the temporary erosion control devices must be completed before start of any grading.

As-built drawings shall be completed by the Contractor, and submitted to the Engineer upon completion of construction and prior to the acceptance of the improvements by the District. As-built drawings shall include all changes made during construction and shall be signed by the engineer of record and the contractor. In addition, a digital copy of the plans and survey control shall be submitted for the District's use.

As-built drawings should follow the following guidelines:

1. Original data that is superseded shall be crossed/hatched out.
2. New data shall be border clouded and identified with the respective revision number within a triangle.
3. Do not eradicate original figures, nor make corrections over them.
4. All lettering must be clear and legible.
5. Extensive changes, which cannot be made clearly on the original plan, should be made on a new sheet (supplemental sheet). The new sheet shall be signed by the Building Manufacturer's Engineer and included with the "RECORD DRAWINGS". Any supplemental sheet shall be of the same quality as the original plans. The sheets that these replace must remain in the plan set but shall be crossed out with a note in the revisions block which identifies that this sheet is superseded by the replacement sheet number.
6. All revisions must be noted within a revision block on the applicable sheet with revision number, description, date revised, and approval initial/date by the Town Engineer.
7. An index of all plan revisions shall be included on the title (first) sheet of the plans. This shall include the revision number; date revised, sheet numbers of revisions and Engineer approval initial and date.
8. The following data shall be shown on plans:
    a. Contract change order number where applicable.
    b. Revision in alignment and grade revisions in excess of 0.1 foot for paved areas and in designated drainage ways where such deviations are significant.
    c. Length, size, flow line elevations, and station of culverts.
    d. Drainage changes.
    e. All underground utilities and appurtenant features.
    f. Revision of typical sections.

Electronic Submittal Format

Electronic files shall be submitted to the District in the following format:

1. AutoCAD 2011 (or older) format *.dwg CAD files to generate all final drawings and maps, with any associated images as georeferenced 8-bit PC format TIFF files, with coordinate system defined.

5-1.02 LINES AND GRADES

Subsection 5-1.26, "Construction Surveys" of the Standard Specifications is deleted.

Stakes or marks will ***not*** be set by the District. The Contractor shall be responsible for providing the construction staking necessary to establish the locations and grades required for the completion of

the work specified in these specifications, on the plans, and in the special provisions. An AutoCAD file will be provided at no cost for use by the Contractor for construction staking.

5-1.03 GUARANTEE

GENERAL

The Contractor shall guarantee the work is in accordance with contract requirements and remains free from substantial defects in materials and workmanship for a period of one year after contract acceptance. For certain portions of the work where the District relieves the Contractor of responsibility in accordance with Section 5-1.38, "Maintenance and Protection Relief," of the Standard Specifications, the guarantee period starts on the relief date and ends one year there from. Substantial defects in materials and workmanship means defective work objectively manifested by damaged, displaced, or missing parts or components and workmanship resulting in improper function of materials, components, equipment, or systems, as installed or manufactured by the Contractor, subcontractor, supplier, or manufacturer.

During the guarantee period, the Contractor shall repair or replace contract work and associated work which is not in accordance with contract requirements or has substantial defects in materials and workmanship. The Contractor shall perform the corrective work with no expense to the District other than District provided field inspection services.

The guarantee of work excludes damage or displacement that is outside the control of the Contractor and caused by normal wear and tear, improper operation, insufficient maintenance, abuse, unauthorized modification, or natural disaster as described in Section 5-1.39B “Damage Caused by an Act of God” of the Standard Specifications.

In the case of conflict between this guarantee provision and any warranty provision included in the contract, the warranty provision shall govern for the specific construction product or feature covered.

CORRECTIVE WORK

During the guarantee period, the District will monitor performance of the facilities completed by the Contractor and will perform a thorough review of the contract work at least 60 days before the expiration of the one-year guarantee.

If the District discovers contract work not in compliance with contract requirements or that has substantial defects in materials and workmanship, at any time during the guarantee period, a list of items that require corrective work will be developed and forwarded to the Contractor. Within 15 days of receipt of a list, the Contractor shall submit to the District a detailed plan for performing corrective work. The work plan shall include a start to finish schedule. It shall include a list of labor, equipment, materials, and any special services intended to be used. The Contractor shall start the corrective and related work within 15 days of receiving notice from the District that the Contractor’s work plan is approved. The corrective work shall be diligently prosecuted and completed within the time allotted in the approved work plan.

If the District determines that corrective work, covered by the guarantee, is urgently needed to prevent injury or property damage, the District will give the Contractor a request to start emergency repair work and a list of items that require repair work. The Contractor shall mobilize within 24 hours and diligently perform emergency repair work. The Contractor shall submit a work plan within 5 days of starting emergency repair work

If the Contractor fails to commence and execute, with due diligence, corrective work and related work required under the guarantee in the time allotted, the District may proceed to have the work performed by District forces or other forces at the Contractor's expense. Upon demand, the

Contractor shall pay all costs incurred by the District for work performed by Town forces or other forces including labor, equipment, material, and special services.

PAYMENT

Full compensation for performing corrective work, and related work such as traffic control and temporary erosion control and to maintain insurance coverage and bonds, shall be considered as included in the contract prices paid for the various contract items of work and no separate payment will be made therefore.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.04, "Public Safety," of the Standard Specifications and these special provisions. The Contractor shall install portable chainlink fence panels around the limits of the construction area. Accessibility to, and use of, the existing building and adjacent parking/storage areas by District personnel shall be maintained at all times. The District will provide sufficient laydown and storage space of east of the addition for the Contractor's use at no cost. Security of this area and the construction area is the Contractor's responsibility.

5-1.05 QUALITY

Testing of materials and work shall conform to the provisions in Section 6-3, "Quality," of the Standard Specifications and these special provisions.

Tests or testing shall mean tests to assure the quality and to determine the acceptability of the materials and work. Quality Assurance testing and inspection will be provided by the District. Quality Control described in Section 11, "Quality Control and Assurance," of the Standard Specifications shall be the Contractor's responsibility. All samples shall be furnished by the Contractor without cost to the District. The District may waive sampling and testing if adequate information, properly certified, is available to indicate that materials comply with the terms of specifications. The Contractor shall be responsible for constructing the Project in accordance with the plans and specifications with or without sampling and testing.

Testing standards are further described in Section 11, "Quality Control and Assurance," of the Standard Specifications. Specific testing and testing standards required of the Contractor are further described in the material and work item sections of the Standard Specifications. Quality Control and Quality Assurance requirements shall be adhered to for the material or item of work unless specifically stated otherwise within the Project special provisions.

The District will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the District, and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the District.

5-1.06 RESPONSIBILITY TO OTHER ENTITIES

The Contractor shall be responsible for any liability imposed by law and for injuries to or death of any person including, but not limited to, workers and the public or damage to property, and shall indemnify and save harmless any county, city or district, its officers and employees connected with the work, within the limits of which county, city or district the work is being performed, all in the same manner and to the same extent conforming to the provisions in Section 7-1.01 "Insurance Policies" of these Special Provisions, for the protection of the District and all officers and employees thereof connected with the work.

5-1.07 PROMPT PROGRESS PAYMENT TO SUBCONTRACTORS

Attention is directed to the provisions in Sections 10262 and 10262.5 of the Public Contract Code concerning prompt payment to subcontractors.

5-1.08 RECORDS

The Contractor shall maintain cost accounting records for the contract pertaining to, and in such a manner as to provide a clear distinction between, the following six categories of costs of work during the life of the contract:

A. Direct costs of contract item work.
B. Direct costs of changes in character in conformance with Section 4-1.05B, "Work-Character Changes," of the Standard Specifications.
C. Direct costs of extra work in conformance with Section 4-1.05, "Changes and Extra Work," of the Standard Specifications.
D. Direct costs of work not required by the contract and performed for others.
E. Direct costs of work performed under a potential claim record in conformance with the provisions in Section 5-1.43, "Potential Claims and Dispute Resolution," of the Standard Specifications.
F. Indirect costs of overhead.

Cost accounting records shall include the information specified for daily force account work reports in Section 9-1.04, "Force Account," of the Standard Specifications. The requirements for furnishing the Engineer completed daily force account reports shall only apply to work paid for on a force account basis.

The cost accounting records for the contract shall be maintained separately from other contracts, during the life of the contract, and for a period of not less than three years after the date of acceptance of the contract. If the Contractor intends to file claims against the District, the Contractor shall keep the cost accounting records specified above until complete resolution of all claims has been reached.

5-1.09 PROJECT APPEARANCE

The Contractor shall maintain a neat appearance to the work. In areas visible to the public, the following shall apply:

A. When practicable, debris developed during clearing and grubbing shall be disposed of concurrently with its removal. If stockpiling is necessary, the material shall be removed or disposed of weekly.
B. Trash bins shall be furnished for debris from structure construction. Debris shall be placed in trash bins daily and covered nightly and during storms. Forms or falsework that are to be re-used shall be stacked neatly concurrently with their removal. Forms and falsework that are not to be re-used shall be disposed of concurrently with their removal.
C. Trash within the construction area shall be picked up daily.

Full compensation for conforming to the provisions in this section, not otherwise provided for, shall be considered as included in prices paid for the various contract items of work involved and no additional compensation will be allowed therefore.

5-1.10 ARCHAEOLOGICAL DISCOVERIES

If archaeological materials, including but not limited to human skeletal material and disarticulated human bone, are discovered at the job site, immediately notify the District upon discovery of archaeological materials and leave undisturbed and in place archaeological materials discovered on

the job site. This work shall be considered as included in the contract price paid for various items of work involved and no additional compensation will be allowed therefore.

When ordered by the District to furnish labor, material, tools and equipment, for securing the location of the find, and assist in the investigation or recovery of archaeological materials and the cost will be paid for as extra work as provided in Section 4-1.05, "Changes and Extra Work," of the Standard Specifications.

5-1.11 ENVIRONMENTAL HAZARD DISCOVERIES

If environmental hazards are discovered, it shall be brought to the District's attention immediately. When ordered by the District to furnish labor, material, tools and equipment, for removing and relocating contaminated soil, or removing underground storage tanks, the cost will be paid for as extra work as provided Section 4-1.05, "Changes and Extra Work," of the Standard Specifications.

5-1.12 PARTIAL PAYMENT

From each progress estimate, five percent (5%) will be deducted and retained by the District, and the remainder, less the amount of previous payments, will be paid to the Contractor. All retained amounts will be paid to the Contractor on the first working day following 35 days after the date of recordation of the Notice of Completion for the work.

All progress payments and/or final payments, with the exception of contract retention, shall be paid by the District within thirty (30) days of receipt of invoices for such work, upon approval by the District Engineer.

Partial payment will be made for materials on hand but not incorporated into the work during that month.

5-1.13 SUBMITTALS

Submittal of the building drawings, structural calculations and supporting documentation to the District must occur no later than April 15, 2017, assuming Notice of Award is issued on February 1, 2017.

The Contractor must provide the Submittals referenced below to the Engineer within forty-five (45) calendar days after Notice of Award and prior to the issuance of a Notice to Proceed. The Engineer will review and work with the Contractor cooperatively to approve the Contractor's submittals.

- Contractor must submit the name and address of the authorized representative who is to receive all written notices under this contract.
- Contractor must submit a Construction Schedule for the Engineer's review and approval. If the Engineer requires changes to the initial Construction Schedule, the Contractor shall provide the Engineer with a revised schedule within five (5) working days of receipt of the Notice to Proceed. The schedule shall include and clearly identify the controlling items of work. Subsequent Schedules shall be updated and submitted to the Engineer if the Contractor falls behind the initially approved schedule by more than five days. Contents of all schedules shall conform to Section 8-1.02 "Schedule" of the Standard Specifications.
- Product Data Sheets for:
    - Metal Building Information as described on S1.1 and Division 5 Specifications
    - Concrete Mix Design for structure and exterior flat work
    - Fire Sprinkler System
    - Thermal and Moisture Protection
    - Seismic Joint construction
    - Doors and Windows including operators and hardware
    - Paints and Coatings

- Mechanical and HVAC equipment as described in the Technical Specifications
- Electrical equipment as described in the Technical Specifications
- Asphalt Concrete mix design for paving and patching.

When weekly schedule update submittals are required, the provisions regarding this submittal and progress payments shall be in accordance with Section 8-1.02, “Schedule,” of the Standard Specifications. Approval of all submittals by the Engineer does not relieve the Contractor of his responsibility to perform the work in an acceptable manner and in accordance with the plans, the Standard Specifications, and these Special Provisions.

The Contractor shall provide two copies of submittals for materials to be used in construction of the project.

5-1.14 DELETED

Section 5-1.09 “Partnering” of the Standard Specifications is deleted

Section 5-1.13B “Disadvantaged Business Enterprises” of the Standard Specifications is deleted

Section 5-1.13D “Non-Small Businesses” of the Standard Specifications is deleted

SECTION 6. CONTROL OF MATERIALS

6-1.01 DELETED

Section 6-2.05 “Buy America” of the Standard Specifications” is deleted.

SECTION 7. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

7-1.01 INSURANCE POLICIES

Subsection 7-1.06D, "Liability Insurance," of the Standard Specifications is modified by the insurance requirements outlined in the Construction Contract attached as *Attachment A.* See Section 20 "Indemnification and Insurance" of the Construction Contract for insurance requirements.

TERM OF COVERAGE

Contractor shall maintain all insurance required by this contract from the time services commence until services are completed, except as may be otherwise required by this section. Contractor shall replace any policies, certificates and endorsements for any insurance expiring prior to completion of the services.

RESPONSIBILITY FOR DAMAGE

As between the District and Contractor, Contractor shall take and assume all responsibility for the work as stated herein and/or shown on the plans. The District shall not be liable for any accident, loss or damage to the work prior to its completion and acceptance, except as provided in Section 5-1.39B of the Standard Specifications.

The Contractor shall bear all losses and damages directly or indirectly resulting to him to the District, its officers, employees and agents, or to others on account of the performance or character of the work, unforeseen difficulties, accidents or any other causes whatsoever.

To the same extent set forth in Section 7-1.05A, the Contractor shall assume the defense of and indemnify and save harmless the District, its officers, employees, and agents, from and against any and all claims, losses, damage, expenses and liability of every kind, nature, and description, directly or indirectly arising from the performance of the contract or work, regardless of responsibility for negligence, and from any and all claims, losses, damage, expenses, and liability, however the same may be caused, resulting directly, or indirectly from the nature of the work covered by the contract, regardless of responsibility for negligence, to the fullest extent permitted by law. In accordance with Civil Code Section 2782, nothing in Section 7 of the Standard Specifications shall require defense or indemnification for death, bodily injury, injury to property, or any other loss, damage or expense arising from the sole negligence or willful misconduct of the District, or its agents, servants or independent contractors who are directly responsible to the District, or for defects in design furnished by such persons. Moreover, nothing in Section 7 shall apply to impose on the Contractor, or to relieve the District from liability for active negligence of the District.

No act by the District, or its representatives in processing or accepting any plans, in releasing any bond, in inspecting or accepting any work, or of any other nature, shall in any respect relieve the Contractor or anyone else from any legal responsibility, obligation or liability he might otherwise have.

7-1.02 PREVAILING WAGE

At all times during the course of Contractor's work on the Project, Contractor shall remain registered with the Department of Industrial Relations and qualified to perform public work pursuant to Labor Code Section 1725.5, and Contractor shall ensure that all subcontractors employed on the Project by Contractor also remain so registered.

The Contractor is responsible for posting prevailing wage job site notices required by DIR in a place accessible to all employees. (http://www.dir.ca.gov/wpnodb.html)

STATE PREVAILING WAGE

Attention is directed to Section 7-1.02K(2), "Wages," of the Standard Specifications. The contractor shall pay State of California prevailing wages consistent with California Law.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates available from the California Department of Industrial Relations' Internet web site at http://www.dir.ca.gov/DLSR/PWD

Contractor shall comply, and shall require each subcontractor employed by Contractor on the Project to comply, with the requirements of Labor Code Section 1776, including without limitation the requirement to maintain certified payroll records. Contractor shall submit certified payroll records directly to the California Labor Commissioner. At all times during the course of Contractor's work on the Project, Contractor shall remain registered with the Department of Industrial Relations and qualified to perform public work pursuant to Labor Code Section 1725.5, and Contractor shall ensure that all subcontractors employed on the Project by Contractor also remain so registered. Pursuant to Labor Code Section 1771.1(a), a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal (subject to the requirements of Section 4104 of the Public Contract Code), or engage in the performance of any contract for public work, as defined in Chapter 1 of Part 7 of Division 2 of the Labor Code, unless currently registered with the Department of Industrial Relations and qualified to perform public work pursuant to Section 1725.5. However, an unregistered contractor may submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Sections 10164 or 20103.5 of the Public Contract Code, provided that the contractor is registered to perform public work at the time the contract is awarded. This project is subject to compliance monitoring and enforcement by the California Department of Industrial Relations.

7-1.03 PAYROLL RECORDS

Contractor shall comply, and shall require each subcontractor employed by Contractor on the Project to comply, with the requirements of Labor Code Section 1776, including without limitation the requirement to maintain certified payroll records. Contractor shall submit certified payroll records directly to the California Labor Commissioner.

Subsection 7-1.02K(3) "Certified Payroll Records" of the Standard Specifications is deleted in its entirety and replaced as follows:

Pursuant to Labor Code Section 1776, the Contractor and each subcontractor shall maintain weekly certified payroll records showing the name, address, social security number, work classification, straight time and overtime hours paid each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker or other employee employed in connection with the work. Contractor shall certify under penalty of perjury that records maintained and submitted by Contractor are true and accurate. Contractor shall also require subcontractor(s) to certify weekly payroll records under penalty of perjury.

The payroll records described herein shall be certified and submitted by the Contractor at a time designated by the District. The Contractor shall also provide the following:

1) A certified copy of the employee's payroll records shall be made available for inspection or furnished to such employee or his or her authorized representative on request.
2) A certified copy of all payroll records described herein shall be made available for inspection or furnished upon request of the Department of Industrial Relations ("DIR").

The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement ("DLSE") of the DIR or shall contain the same information as the forms provided by the DLSE.

Any copy of records made available for inspection and furnished upon request to the public shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address, and social security number. The name and address of the Contractor or any subcontractor shall not be marked or obliterated.

In the event of noncompliance with the requirements of this Section, the Contractor shall have ten (10) days in which to comply subsequent to receipt of written notice specifying any item or actions necessary to ensure compliance with this section. Should noncompliance still be evident after such ten (10) day period, the Contractor shall, as a penalty to the District, forfeit Twenty-five Dollars ($25.00) for each day, or portion thereof, for each worker until strict compliance is effectuated. Upon the request of the DIR, such penalties shall be withheld from contract payments.

7-1.04 DELETED

Section 7-1.02B U.S. Fair Labor Standards Act of the Standard Specifications is deleted.

Section 7-1.11 "Federal Laws for Federal-Aid Contracts" of the Standard Specifications is deleted.

SECTION 8. PROSECUTION AND PROGRESS

8-1.01 TERMINATION OF CONTRACT

(a) Attention is directed to the provisions in Section 8-1.13 and Section 8-1.14 of the Standard Specifications.

(b) If the District deems that a Contractor has failed to supply an adequate working force or material of proper quality, or has failed in any other respect to prosecute the work with the diligence and force specified by the contract, the District may:

(1) After written notice of at least five days to the Contractor, specifying the defaults to be remedied, provide any such labor or materials and deduct the cost from any money due or to become due to the Contractor under the contract; or

(2) If he considers that the failure is sufficient ground for such action, he may give written notice of at least five days to the Contractor and the Contractor's sureties, indicating that if the defaults are not remedied the Contractor's control over the work will be terminated.

(c) If the defaults are not remedied within the time specified in the notice, the Contractor's control shall terminate as of the expiration of that time.

(d) Upon such termination, the District may take possession of and use all or any part of the Contractor's materials, tools, equipment, and appliances upon the premises to complete the contract. Thereupon he may permit the surety to complete or cause the contract work to be completed, or he may direct that all or any part of the work be completed by day's labor or by employment of other Contractors on informal contracts, or both.

(e) If the control of a Contractor is terminated or he abandons the work, and the work is performed by day's labor or informal contract as provided in Section (d) above, he is not entitled to receive any portion of the amount to be paid under the contract until it is fully completed. After completion, if the unpaid balance exceeds the sum of the amount expended by the District in finishing the work, plus all damages sustained or to be sustained by the District, the excess not otherwise required by law to be retained shall be paid to the Contractor, but if such sum exceeds the unpaid balance, the Contractor and his surety are liable to the District for the excess. If the surety completes the contract work, such surety shall be subrogated to money due under the contract and to money which shall become due in the course of completion by the surety, to the extent provided by law.

8-1.02 DELETED

Section 8-1.10A "General" of the Standard Specifications is deleted.

SECTION 9. PAYMENT

9-1.01 DELETED

Section 9-1.07 “Payment Adjustments for Price Index Fluctuations” of the Standard Specifications is deleted

SECTION 10. TECHNICAL SPECIFICATIONS

Summary for Airport Vehicle Maintenance Building Addition

Division 1 General Requirements:
Provide temporary facilities, such as BMP's, temporary toilets, fencing, and staging areas as required and indicated on the Civil Drawings. All construction shall meet the Code Compliance requirements as set forth on Sheet CVR of the Drawings.

Division 2 Site Construction:
Provide erosion control, excavation, utility connections/relocation, and asphalt paving as indicated on Civil Drawings.

Division 3 Concrete:
Provide concrete mixes and steel reinforcing per Structural Drawings

Division 4 Masonry: **NA**

Division 5 Metals:
See attached Section Metal Building Systems
Provide all metal materials per Drawings, with gauges as indicated. Metal stairs to be grated and shall have closed risers. Match existing colors and profiles. Provide shop drawings for metal sliding gates at Mezzanine Level, per CVR Sheet of Drawings. Building Supplier to provide all drawings and structural calculations for approval by the Nevada County Building Department prior to fabricating metal building frame components and connections.

Division 6 Wood and Plastics:
Provide ½" plywood on interior side of added walls, up to 8' in height, painted.

Division 7 Thermal and Moisture Protection:
Provide foundation waterproofing, air infiltration wrap, building insulation, and roofing with ice dam membrane per local codes, as indicated on the Drawings. All building insulation materials shall be compliant with ASTM E 84 requirements for flame/smoke. Provide all exterior metal siding, roofing and flashing as required for a complete watertight building envelope.

Division 8 Doors and Windows:
Provide insulated core metal exterior doors with full weather-stripping and aluminum threshold, colors to match existing. Match existing door hardware and keying.
Windows: Milgard OAE with dual panel glazing.
Garage Doors: Overhead Door Company, OAE. Sectional roll up style with Operators.
Canister Door: rollupdoorsdirect.com, Series 650 Mini, with Operator.

Division 9 Finishes:
Gypsum Board: **NA**
Paints and Coatings: Provide low to zero VOC per California Green Building Code, color scheme to match existing, or as SBO. Provide color samples for Architect/Owner review.

Division 10 Specialties: **NA**

Division 11 Equipment: **NA**

Division 12 Furnishings: **NA**

Division 13 Special Construction: **NA**

Division 14: **NA**

Division 21 Fire Suppression:
See attached Sections 210010, 210050, 210518, 210548 and 211313

Division 22 Plumbing:
See attached Sections 220010, 220518, 220523, 220529, 220553, 221116, 221119, 221316, 221319, 221513

Division 23 HVAC:
See attached Sections 230010, 231123, 235523

Division 26 Electrical:
See attached Sections 260511, 260519, 260526, 260533, 260541, 260573, 260923, 262300, 262413, 262416, 262726, 264313, 265100, 265600

Attachment “A”

CONSTRUCTION CONTRACT

THIS CONSTRUCTION CONTRACT (hereinafter “Contract”) is made on the date set forth below, by and between the Truckee Tahoe Airport District (hereinafter “District”) and_____, a _____(hereinafter “Contractor”).

WITNESSETH:

NOW, THEREFORE, in consideration of the mutual promises exchanged herein and other good and valuable consideration the receipt and adequacy of which is hereby acknowledged, IT IS HEREBY AGREED AS FOLLOWS:

1. Contract Documents.

The complete Contract consists of the following documents, to wit:

Notice Inviting Bids
Instructions to Bidders
Bid Proposal Form
Accepted Bid (Including Bid Sheet)
Construction Contract
Payment Bond to Accompany Contract
Performance Bond to Accompany Contract
Specifications and General, Supplemental and Special Conditions, (if any)
Working Details and Plans
All Addenda, Change Orders, and Change Order Forms
State of California Department of Transportation Standard Specifications (Latest Edition)

Any and all obligations of the District and the Contractor are fully set forth and described therein. All of the above documents are intended to cooperate so that any Work called for in one and not mentioned in the other or vice versa is to be executed the same as if mentioned in all said documents. The documents comprising the complete Contract are sometimes hereinafter collectively referred to as the Contract Documents. All performance, payment bonds, and insurance required shall be in the possession of the District prior to commencement of Work and shall be issued by verified California licensed or admitted insurers.

2. The Work.

The District hereby promises and agrees with the Contractor to employ, and does hereby employ said Contractor to provide the materials and to do the Work according to the terms and conditions herein contained and referred to for the price aforesaid, and hereby contracts to pay the same at the time, in the manner and upon the conditions set forth in the Specifications; and the parties for themselves, their heirs, executors, administrators, successors and assigns, do hereby agree to the full performance of the covenants herein contained.

The Contractor agrees to furnish all work, labor, tools, materials, transportation, equipment, services and other means of construction necessary to perform and complete in a good and workmanlike manner, those certain improvements entitled: Vehicle Maintenance Building Addition as called for, and in the manner designated in, and in strict conformity with, the Plans and Specifications dated

December 15, 2016.

It is understood and agreed that the Work, labor, tools, materials, transportation, equipment, services and other means of construction shall be furnished and the Work performed and completed as required in the Plans and Specifications under the sole direction and control of the Contractor, and subject to inspection and approval of the District, its representatives or regulatory authorities. The Town hereby designates as its representative for the purpose of this Contract the following named person: _____.

It is understood and agreed that the Contractor has, by careful examination, satisfied itself as to the nature and location of the Work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the District, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.

3. Contract Price.

For furnishing all said materials and labor, tools and equipment, and doing all the Work contemplated and embraced in this Agreement, also for all loss and damage arising out of the nature of the Work aforesaid, or from the action of the elements, or from any unforeseen difficulties which may arise or be encountered in the prosecution of the Work until its acceptance by the District, and for all risks of every description connected with the Work; also for all expenses incurred by or in consequence of the suspension or discontinuance of Work, except such as in the said specifications are expressly stipulated to be borne by the District; and for well and faithfully completing the Work and the whole thereof, in the manner shown and described in said Plans and Specifications, the District will pay and the Contractor shall receive in full compensation therefore the lump sum price, or if the bid is on the unit price basis, the total price for the several items furnished pursuant to the specifications, named in the schedule of the Proposal in the amount of _____ ($_____).

4. Time for Performance.

The Contractor shall diligently prosecute the Work to completion as provided in the Conditions.

5. Permits; Compliance with Law.

The Contractor shall, at its expense, obtain all necessary permits and licenses, easements, etc., for the construction of the project, give all necessary notices, pay all fees required by law, and comply with all laws, ordinances, rules and regulations relating to the Work and to the preservation of the public health and safety, except the District shall pay all fees necessary for the issuance of the Nevada County Building Permit. Any dispute arising from Contractor’s obtaining, failure to obtain, or comply with any such laws or regulations shall be within the indemnification requirements of Section 20.0 of this Contract.

Contractor and all subcontractors used by Contractor agree to comply with all applicable Federal, State or Town statues and regulations including but not limited to those pertaining to nondiscrimination, equal employment opportunity, affirmative action, employment of the handicapped, and land use. The District reserves the right to terminate this Agreement for failure by the Contractor to comply with any and all applicable local, state, or federal laws.

6. Inspection by District.

The Contractor shall at all times maintain proper facilities and provide safe access for inspection by the District and Regulatory Authorities to all parts of the Work, and to the shops wherein the Work is in preparation. Where the Specifications require Work to be specially tested or approved, it shall not be tested or covered up without timely, written approval by the District or Regulatory Authorities. Should any such Work be covered up without such notice, approval, or consent, it must, if required by Town or Regulatory Authorities, be uncovered for examination at the Contractor’s expense.

7. Notice.

Any notice from one party to the other under this Contract shall be in writing and shall be dated and signed by the party giving such notice or by a duly authorized representative of such party. Any such notice shall not be effective for any purpose whatsoever unless served in the following manner.

(a) If the notice is given to the District, by personal delivery thereof to the District Manager, or by depositing the same in the United States mail, enclosed in a sealed envelope, addressed to the District Manager, postage prepaid and certified;

(b) If the notice is given to the Contractor, by personal delivery thereof to said Contractor or to its duly authorized representative at the site of the project, or by depositing the same in the United States mail, enclosed in a sealed envelope, addressed to the Contractor at the address set forth below; or

(c) If the notice is given to the surety or any other person, by personal delivery to such surety or other person, or by depositing the same in the United States mail, enclosed in a sealed envelope, addressed to such surety or other person, as the case may be, at the address of such surety or person last communicated by it to the party giving the notice, postage prepaid and certified.

District:	**Contractor:**
Truckee Tahoe Airport District	Name
10356 Truckee Airport Road	Mailing Address
Truckee, CA 96161	Physical Address
Attn: Kevin Smith	City, State, Zip
District Manager	Attn: _____

8. Accident Prevention.

Precaution shall be exercised at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery, equipment, and other hazards shall be guarded or eliminated in accordance with the safety provisions of the Construction Safety Orders issued by the Occupational Safety and Health Standards Board of the State of California.

9. Contractor’s Warranty and Guarantee.

Warranty:

The District shall not, in any way or manner, be answerable or suffer loss, damage, expense or liability for any loss or damage that may happen to said building, Work, or equipment or any part thereof, or in, on, or about the same during its construction and before acceptance.

Contractor unqualifiedly warrants all Work and materials to be free of defects whether performed or installed by it or by any subcontractor or supplier in the project which is the subject of this Contract, unless a lesser quality is expressly authorized in the Plans and Specifications, in which event Contractor unqualifiedly warrants such lesser quality. Contractor further warrants that the Work as performed by Contractor, subcontractor, or supplier will conform with the Plans and Specifications or any written authorized deviations there from. Contractor’s obligations under this Section 9 shall survive the termination or expiration of this Contract.

Guarantee:

(a) In addition to warranties, representations and guarantees stated here elsewhere in the Contract Documents, the Contractor unconditionally guarantees all materials and workmanship furnished hereunder, and agrees to replace at its sole cost and expense, and to the satisfaction of the District, any and all materials which may be defective or improperly installed.

(b) The Contractor shall repair or replace to the satisfaction of the District any or all such Work that may prove defective in workmanship or materials, ordinary wear and tear excepted, together with any other Work which may be damaged or displaced in so doing.

(c) In the event of failure to comply with the above stated conditions within a reasonable time, the District is authorized to have the defect repaired and made good at the expense of the Contractor who will pay the costs and charges therefore immediately upon demand, including any reasonable management and administrative costs, and engineering, legal and other consultant fees incurred to enforce this section.

(d) The signing of this Contract by the Contractor shall constitute execution of the above guarantees. Except as otherwise provided in this Contract, the guarantees and warranties shall remain in effect for a period of one (1) year after final acceptance of the Work by the District pursuant to the Conditions.

10. Liquidated Damages.

Liquidated damages as provided in the Conditions of this Contract shall be in the sum specified for each and every day as defined therein.

11. Apprentices.

Contractor agrees to be bound by and comply with the provisions of sections 1777.5 et seq. of the Labor Code in respect to apprentices.

12. Prevailing Wages.

The Contractor acknowledges that it has examined the prevailing rate of per diem wages as established by the California Director of Industrial Relations. The Contractor agrees to pay workers not less than the applicable prevailing rate of per diem wages, as set forth in these requirements.

Contractor shall comply, and shall require each subcontractor employed by Contractor on the Project to comply, with the requirements of Labor Code Section 1776, including without limitation the requirement to maintain certified payroll records. Contractor shall submit certified payroll records directly to the California Labor Commissioner. At all times during the course of Contractor’s work on

the Project, Contractor shall remain registered with the Department of Industrial Relations and qualified to perform public work pursuant to Labor Code Section 1725.5, and Contractor shall ensure that all subcontractors employed on the Project by Contractor also remain so registered. Pursuant to Labor Code Section 1771.1(a), a contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal (subject to the requirements of Section 4104 of the Public Contract Code), or engage in the performance of any contract for public work, as defined in Chapter 1 of Part 7 of Division 2 of the Labor Code, unless currently registered with the Department of Industrial Relations and qualified to perform public work pursuant to Section 1725.5. However, an unregistered contractor may submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Sections 10164 or 20103.5 of the Public Contract Code, provided that the contractor is registered to perform public work at the time the contract is awarded. This project is subject to compliance monitoring and enforcement by the California Department of Industrial Relations.

13. Severability.

Nothing contained in this Contract shall be construed so as to require the commission of any act contrary to law. Should a conflict arise between any provision contained herein and any present or future statute, law, ordinance or regulation contrary to which the parties have no legal right to contract or act, the latter shall prevail and the provision of this Contract which is affected shall be curtailed and limited but only to the extent necessary to bring it within the requirements of the law. If such curtailment or limitation is not possible, the affected provision shall be of no force and effect. Except as aforesaid, such illegality shall not affect the validity of this Contract.

14. Complete Agreement.

This Contract supersedes any and all agreements, either oral or in writing, between the Parties with respect to the subject matter herein. Each party to this Contract acknowledges that no representation by any party which is not embodied herein or any other agreement, statement, or promise not contained in this Contract shall be valid and binding.

15. Interpretation.

(a) The parties hereto acknowledge and agree that each has been given the opportunity to independently review this Contract with legal counsel, and/or has the requisite experience and sophistication to understand, interpret and agree to the particular language of the provisions of this Contract.

(b) In the event of a controversy or dispute between the parties concerning the provisions herein, this document shall be interpreted according to the provisions herein and no presumption shall arise concerning the draftsmanship of such provision.

16. Applicable Law.

(a) The parties hereto understand and agree that the terms of this Contract, and its Exhibits, have been negotiated and executed within the State of California and shall be governed by and construed under the laws of the State of California.

(b) In the event of a dispute concerning the terms of this Contract, the parties hereto

expressly agree that the venue for any legal action shall be with the Truckee Court in the County of Nevada, State of California.

17. Authority to Execute.

Each signatory to this Contract warrants that he or she is authorized to enter into this Contract on behalf of his or her principal.

18. Substitution of Securities.

In the event Contractor elects to make provisions to substitute securities for those otherwise required herein as allowed by Government Code Section 10263 and/or Public Contracts Code Section 22300 or any successor section thereto no such substitution shall be allowed until District and Contractor have executed an agreement in substantially the form required by and set forth in Government Code Section 10263.

19. Dispute Resolution.

In the event of a dispute concerning the interpretation, implementation or performance of this agreement the arbitration provisions set forth in Public Contracts Code Section 22201 shall be used to resolve any such dispute.

20 Indemnification and Insurance.

20.0 Indemnification Requirements.

To the fullest extent allowed by law, Contractor shall indemnify, defend, and hold harmless the District, and its officers, employees, and agents (“District indemnitees”), from and against any and all causes of action, claims, liabilities, obligations, judgments, or damages, including reasonable attorneys’ fees and costs of litigation (“claims”), directly or indirectly arising out of the Contractor’s performance of its obligations under this agreement or out of the operations conducted by Contractor, including the District’s passive negligence, except for such loss or damage arising from the sole negligence or willful misconduct of the District. In the event the District indemnitees are made a party to any action, lawsuit, or other adversarial proceeding arising from Contractor’s performance of this agreement the Contractor shall provide a defense to the District indemnitees or at the District’s option reimburse the District indemnitees their costs of defense, including reasonable attorneys’ fees, incurred in defense of such claims. This indemnification shall extend to claims occurring after this contract is terminated, as well as while it is in force. Contractor shall save, keep and hold harmless the District, its officers, officials, employees, agents and volunteers from all damages, costs or expenses in law or equity that may be at any time arise or be claimed because of damages to property, or personal injury received by reason of or in the course of performing Work, which may be caused by any willful or negligent act or omission by the Contractor or any of the Contractor’s employees, or any subcontractor. Contractor’s obligations under this paragraph shall survive the termination or expiration of this Contract.

20.1 Insurance Requirements.

Contractor shall obtain and shall require its sub-contractors to obtain insurance of the types and in the amounts described below and satisfactory to District. Approval of any such insurance by District does not relieve Contractor or any subcontractor from indemnification liability as set forth in Section 20.0 above. Any requirements for insurance to be maintained after completion of the Work shall survive the termination or expiration of this Contract. Notwithstanding the minimum insurance coverage requirements set forth herein, if Contractor maintains higher limits than the specified minimum limits District requires and shall be entitled to coverage for the higher limits maintained by Contractor. Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the District, its officers, officials, employees and volunteers.

Attachment “A”

Minimum Scope of Insurance:
Coverage shall be no less broad as:

Insurance Services Office (ISO) Commercial General Liability coverage form GC00.01.
ISO form, CA 0001 Auto Liability, Any Auto
Worker’s Compensation as required by the State of California
Surety Bond – Bid, Performance, and Payment Bonds
Professional Liability – if applicable.
Pollution Liability – if applicable.

20.2 Commercial General Liability Insurance.

Contractor shall maintain occurrence version commercial general liability insurance of equivalent form with a combined single limit of not less than $2,000,000 per occurrence. If such insurance contains a general aggregate limit, it shall apply separately to this Contract or be no less than two times the occurrence limit. Coverage shall be continued for one (1) year after completion of the Work.

20.3 Business Automobile Liability Insurance.

Contractor shall maintain business automobile liability insurance or equivalent form with a combined single limit of not less than $1,000,000 per occurrence. Such insurance shall include coverage for owned, hired and non-owned automobiles.

20.4 Worker’s Compensation Insurance.

Contractor shall maintain workers' compensation insurance with statutory limits and employers' liability insurance with limits as required by the California Labor Code and of not less than $1,000,000 per accident, $1,000,000 per disease per employee, and $1,000,000 disease per policy. The policy must include a written waiver of the insurer’s right to subrogate against District. A subrogate waiver endorsement and property completed certificate of insurance will be required.

20.5 Pollution Liability.

If applicable, Contractor shall maintain pollution liability insurance with limits of not less than $1,000,000 per pollution incident. If such insurance contains a general aggregate limit, it shall apply separately to this project or be no less than two times the occurrence limit. Coverage must apply to pollution incident at, or from any location at, which Contractor is performing Work under this agreement. Insurance must be continued for one (1) year after completion of the Work.

20.6 Insurance Endorsements.

20.6.1 Additional Insured.

Except Workers’ Compensation insurance, all policies of insurance required hereunder shall be endorsed to name District, its officials, officers, employees, and agents as insureds with respect of performance of services. Such insured status shall contain no special limitations in the scope of its protection to the above-listed insureds. All insurance shall be primary with respect to any insurance or self-insurance programs covering District, its officials, officers, employees, and agents and shall contain standard separation of Insured’s provisions. As respects General Liability insurance, District must be an additional insured for liability arising out of ongoing and completed operations by or on behalf of the Contractor and District shall continue to be an additional insured for completed operations for one (1) year after completion of Work.

20.6.2 Primary and Noncontributory Insurance.

The Contractor’s insurance coverage shall be primary insurance as respects the District, its officers, officials, employees and volunteers, which shall be reflected in endorsements to each policy. Any insurance or self-insurance maintained by the District, its officers, officials, employees and volunteers shall be excess of the Contractor’s insurance and shall not contribute with it.

20.7 Certificates of Insurance.

Contractor shall, prior to commencement of the Work, furnish to District properly executed certificates of insurance, and copies of policy endorsements, which shall clearly evidence all insurance required in this Section.

20.8 Term of Coverage.

Contractor shall maintain all insurance required by this Contract from the time services commence until services are completed, except as may be otherwise required by this section. Contractor shall replace any policies, certificates and endorsements for any insurance expiring prior to completion of the services.

20.9 Additional Insurance Requirements.

Contractor shall provide immediate written notice if (1) any of the required insurance policies is terminated; (2) the limits of any of the required policies are reduced; or (3) the deductible or self-insured retention is increased. Written notice by certified mail, return receipt requested, shall be provided to:

Truckee Tahoe Airport District
Attn: General Manager
10356 Truckee Airport Road
Truckee, CA 96161

All liability insurance shall be on an occurrence basis. Insurance on a claims-made basis will be rejected. Any deductibles or self-insured retentions shall be declared to and approved by District. The Insurer shall provide an endorsement to District eliminating such deductibles or self-insured retentions as respects the District, its officials, employees and volunteers.

Contractor shall furnish to District certificates of insurance and endorsements, duly authenticated, giving evidence of the insurance coverage's required in this contract and other evidence of coverage or copies of policies as may be reasonably required by District from time to time. Insurance shall be placed with insurers with a A.M. Best Company rating of no less than A:VIII.

All subcontractors employed on the Work referred to in this Contract shall meet the insurance requirements set forth for Contractor. Contractor shall furnish certificates of insurance and endorsements for each subcontractor at least five (5) days prior to the subcontractor entering the job site, or Contractor shall furnish District an endorsement including all subcontractors as insureds under its policies.

In the event that any required insurance is reduced in coverage, cancelled for any reason, voided or suspended, Contractor agrees that District may arrange for insurance coverage as specified, and Contractor further agrees that administrative and premium costs may be deducted from payments due

to the Contractor.

The Contractor insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

20.10 Responsibility for Damage.

As between the District and Contractor, Contractor shall take and assume all responsibility for the Work as stated herein and/or shown on the Plans and Specifications. The District shall not be liable for any accident, loss or damage to the Work prior to its completion and acceptance. No act by the District, or its representatives in processing or accepting any plans, in releasing any bond, in inspecting or accepting any Work, or of any other nature, shall in any respect relieve the Contractor or anyone else from any legal responsibility, obligation or liability it might otherwise have.

21. Right to Withhold Payment.

District may withhold payment to Contractor in the event of a stop notice or default under the provisions of Civil Code Section 9350 et seq.

22. Right to Audit.

District shall have the right, but not the obligation, to audit the project books and records of Contractor at any time prior to the filing of a notice of completion, upon forty-eight (48) hours written notice to Contractor, without charge or expense to District.

23. Termination for Convenience.

District shall have the right, in its sole discretion, to suspend or terminate this contract on Work not performed with no penalty or obligation to Contractor of any type.

24. Expiration Date of Contract.

Notwithstanding any other provision of this agreement, including those incorporated by reference, this contract shall terminate on _____, unless a certificate of completion has been recorded by District on or prior to that date. In the event of such termination, Contractor shall be compensated for any unpaid but completed Work.

Attachment “A”

IN WITNESS WHEREOF, this Contract has been duly executed by the parties hereinabove named, on the day and year written below.

Dated this _____ day of _____, 201___.

TRUCKEE TAHOE AIRPORT DISTRICT

By:

_____
Kevin Smith
District Manager

Approved as to Form:

_____
Brent Collinson
District Attorney

CONTRACTOR

Reviewed and Accepted by Contractor

_____
Signature

_____
Name

_____
Title: [Must be: Chairperson of the Board, President, or Vice President]

_____
Date

_____
Signature

_____
Name

_____
Title: [Must be Secretary, Assistant Secretary, Chief Financial Officer, or Treasurer]

_____
Date

DIVISION 5 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

B. The building and mezzanine framing and foundation shown on drawings is based on a preliminary design by Sunward Corporation. The final building length shall not exceed what is shown on the drawings but may be up to 12-inches shorter in the north/south direction. The net opening widths and heights of the vehicle and storage access roll-up doors shall be as shown on the drawings. The footing design will be revised by the structural engineer based on the lateral and vertical loads provided by the building manufacturer's engineer. The revision will be done at no cost to the Contractor but there will be no additional payment to the Contractor for changes to the foundation sizes and/or locations

C. Section Includes:

1. Structural-steel framing for building and mezzanine
2. Siding
3. Roofing
4. Trim and Soffit
5. Seismic Joint

1.2 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 DESIGN REQUIREMENTS

A. General
1. The building manufacturer will use standards, specifications, recommendations, findings and/or interpretations of professionally-recognized groups such as AISC, AISI, AWS, ASTM, CSA, CWB, MBMA, Federal Specifications, and unpublished research by MBMA as the basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances. The Manufacturer's design, drafting, fabrication and quality criteria, practices, and tolerances shall govern, unless specifically countermanded by the contract documents.
2. Design structural mill sections and built-up plate sections in accordance with:

a. code-appropriate edition of AISC's "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", ANSI/AISC 360 ASD method.

3. Cold-Formed steel structural members and panels will generally be designed in accordance with "Specifications for the Design of Cold-Formed Steel Structural Members", 2007 Edition, ANSI/AISI S-100-07 or CAN CSA S136-07.
4. Design weldments per the following:
5. Structural Welding
   a. Design per AWS D1.1, “Structural Welding Code – Steel”, Latest Edition.
6. Cold-Formed Welding
   a. Design per AWS D1.3, “Structural Welding Code – Sheet Steel”, Latest Edition.
7. Design Code:
   a. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
      1) Governing Building Code: California Building Code.
      2) Year/Version: 2013.
      3) Risk Category: II.
8. Design Loads:
   a. Dead Load – Weight of the building system as determined by manufacturer.
   b. Roof Live Load – 20 psf.
   c. Collateral Load – 3 psf.
   d. Roof Snow Load:
      1) Ground Snow Load, (Pg) – 190.0 psf.
      2) Snow Exposure Coefficient (Ce) – 1.0.
      3) Thermal Coefficient (Ct) – 1.1.
      4) Roof Snow Load (Pf) – 146.3 psf.
      5) Eave Snow Loads – 292.6 psf where applicable per ASCE 7-10 Section 7.4.5.
      6) Drift Snow Loads – Per ASCE 7 -10 Section 7.7.1.
9. Wind Load:
   a. Wind Speed (Vult) – 130 mph.
   b. Wind Exposure – C.
10. Seismic Load:
    a. Spectral response acceleration for short periods (Ss) – 1.293g.
    b. Spectral response acceleration for 1-sec. period (S1) – 0.432g.
    c. Site Class – C.

B. General Serviceability Limits :
   1. Deflection Limits shall be in accordance with the applicable provisions of the Metal Building Systems Manual (MBMA), latest edition.
   2. Vertical Deflections:
      a. Roof Secondary (Purlins) – L/180.
      b. Main Frame roof beams – L/180.
   3. Horizontal Deflections:
      a. Wall Secondary (Girts) – L/120.
      b. Main Frames – H/150 (WIND - ASD), 0.025H (SEISMIC).

4. Vertical deflection limits apply for snow load (50-year mean-recurrence interval) plus collateral load, or the code required live load. The horizontal drift and deflections limits apply for the loads induced by a basic wind speed corresponding to a 10 year mean-recurrence interval.

C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE 7-10.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

1.4 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified on Sheet S1.1.

1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Provide complete erection drawings for the proper identification and assembly of all building components. Drawings will show anchor bolt patterns and settings, transverse cross-sections, sidewall, endwall and roof framing, flashing and sheeting, and accessory installation details.

C. Bill of Materials: Bills of material shall be furnished and shall include item weights.

D. Preventative Maintenance Manual.

E. Delegated-Design Submittal: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer, licensed by the state of California, responsible for their preparation. Calculations shall clearly indicate all vertical and horizontal reactions to supporting foundations.

2. Data (drawings and calculations) prepared by metal building engineer will be included in submittal to Nevada County for the Building Permit

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For erector and manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."

2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components so as not to be damaged or deformed.

B. Unload, store, and erect in a manner to prevent bending, warping, twisting, and surface damage.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. Furnish manufacturer’s standard warranty for the metal building system, excluding paint.

B. The manufacturer shall warranty the metal building system against failure due to defective material or workmanship for a period of one (1) year from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. American Buildings Company; Division of Magnatrax Corp.
2. Star Building Systems; an NCI company.
3. Nucor Building Systems.
4. O.A.E.
5. Sunward Corporation

B. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building structural system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure.

C. Primary-Frame Type:
   1. Rigid Modular: Solid-member, structural-framing system with interior columns.

D. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

E. Eave Height : As indicated by nominal height on Drawings

F. Bay Spacing: As indicated on Drawings

G. Roof Slope: As indicated on Drawings

2.2 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

   1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

      a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

   2. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

E. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

F. Materials:

1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.

G. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

    a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.3 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.

5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

2.4 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports if required by Nevada County.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF DIVISION 5

SECTION 210010 – GENERAL PROVISIONS FOR FIRE-SUPPRESSION, PLUMBING, AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with all provisions of Division 01, Electrical, Civil, and Architectural divisions as they relate to this part of the work. No allowance will be made for failure to review all related documents.

B. Contractor is responsible to the building department for California Title 24 Compliance and Acceptance Testing. See signed Title 24 compliance documentation (T24 sheets), for more information.

1.2 DESCRIPTION

A. Work Included

1. Furnish all labor and materials and perform all operations necessary for the installation of complete and operating mechanical systems subject to the conditions of the contract. The work also includes the completion of such mechanical and electrical details not mentioned or shown which are necessary for the successful operation of all systems; this includes the furnishing of all materials for filling systems to make them operable, including water, refrigerant, oil, grease, antifreeze and brine. Prove satisfactory operation of all equipment and controls to the MECHANICAL ENGINEER on request.

B. Equipment Furnished by Others

1. Rough-in service pipes to locations as required by architectural and mechanical drawings and equipment shop drawings. Provide service valves on all pipes except waste and vent pipes, plug or cap these. Final connections to equipment will be made by the Contractor.

1.3 PROVISIONS

A. Work performed under this division of the specifications shall conform to the requirements of Division 1, and the mechanical drawings and all items hereinafter specified. .

1. The drawings and specifications for the mechanical work are intended to describe a complete mechanical system; omission of minor items obviously necessary to accomplish the above intent shall not relieve the Contractor from furnishing and installing same.

2. Prior to any work being performed under this division examine architectural, structural, food service, electrical, and interior design drawings and specifications and if any discrepancies occur between them and the mechanical drawings and specifications, report same to the Architect in writing and obtain written instructions for the work.
3. Mechanical drawings are diagrammatic, but shall be followed as closely as actual construction of the building will permit. All changes from drawings necessary to make the mechanical work conform to the building as constructed shall be made without additional cost to the Owner.
4. Coordinate the mechanical work with the General Contractor and be responsible to him for satisfactory progress of same. Coordinate mechanical work with all other trades on the project without additional cost to the Owner.
5. All work and materials covered by drawings and specifications shall be subject to review at any time by representatives of the Architect and Owner. If the Architect or Owner's agent finds any materials or installation that does not conform to these drawings and specifications, Contractor shall remove the material from the premises and correct the installation to the satisfaction of the agent.
6. In acceptance or rejection of installed mechanical systems, no allowance will be made for lack of skill on the part of the installers.
7. Visit site prior to bid and verify that conditions are as indicated. Contractor shall include in his bid costs required to make his work meet existing conditions.

1.4 EXAMINATION OF PREMISES/SITE

A. Visit the premises site before submitting bid as no allowance will be made for lack of knowledge of existing conditions.

1.5 CODES AND STANDARDS

A. Comply with all provisions of governing codes, standards, laws, and ordinances. No allowance will be made for lack of understanding or failure to research the requirements for this project.

B. Comply with all utility provider requirements.

1.6 PERMITS, FEES AND NOTICES

A. Apply for and pay for all inspections for this Division of work. Permit fees will be arranged for and paid for by the Owner

B. Notify proper authorities when work is ready for inspections required by applicable codes, rules and regulations, allowing sufficient time for inspections to be made without hindering progress of the work. Furnish to the Owner copies of inspection certificates of acceptance.

1.7 TEMPORARY HEAT

A. Temporary heat will be furnished by the General Contractor. Use of the permanent heating system will not be allowed.

B. Existing systems and conditions shown on drawings for existing buildings are to be noted "for guidance only". The Mechanical Contractor shall field check all existing conditions prior to bidding and is to include in his bid an allowance for removal and/or relocation of existing ductwork, piping, fixtures, or other equipment and adapt new and existing mechanical system to all other work as required.

C. Existing ductwork, equipment, piping, etc. which are not indicated for reuse become the property of the Contractor. However, fixtures, pumps, fans, fire protection equipment, etc. shall become the property of the Owner unless noted otherwise.

D. System outages shall be permitted only at times approved by Owner-in writing. Work which could result in an accidental outage shall be performed with the Owner's maintenance personnel advised of such work.

E. Service shall be maintained to existing areas during construction.

1.8 EXAMINATION OF BIDDING DOCUMENTS

A. Each bidder shall examine the bidding documents carefully, and not later than seven days prior to the date of receipt of bids, shall make written request to the Architect for interpretation or correction of any discrepancies, ambiguity, inconsistency, or error therein which he may discover. Any interpretation or correction will be issued as an addendum by the Architect. Only a written interpretation or correction by addendum shall be binding. No bidder shall rely upon interpretations or corrections given by any other method. If discrepancies, ambiguity, inconsistency, or error are not covered by addendum or written directive, Contractor shall include in his bid, labor materials and methods of construction resulting in higher cost. After award of contract, no allowance or extra compensation will be made on behalf of the Contractor due to his failure to make the written requests as described above.

B. The person submitting the request will be responsible for its prompt delivery. Failure to so request clarification of any inadequacy, omission, or conflict will not relieve the Contractor of responsibility. The signing of the Contract will be considered as implicitly denoting that the Contractor has a thorough comprehension of full intent and scope of the working drawings and specifications.

1.9 MECHANICAL INSTALLATIONS

A. Coordinate mechanical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible, and in accordance with minimum required clearances as specified in codes and regulations.

H. The word "concealed" as used in this specification refers to such spaces as pipe and duct chases, pipe and duct trenches, above plastered ceilings, in walls and buried where pipe and/or duct is inaccessible when building is complete. "Exposed" is intended to be within equipment rooms, unfinished areas, above "push up" ceilings, accessible pipe and duct tunnels.

1.10 SHOP DRAWINGS

A. Equipment specified by name and model number does require shop drawings. Submit shop drawings on all listed equivalent and all substituted (see Paragraph 1.05 below) equipment and for Temperature Controls and Fire Protection.

B. Shop drawings required for this project are as follows:

1. Plumbing fixtures
2. Fans
3. Controls
4. Fire Protection
5. Pipe and Fittings

C. Present shop drawing submittal data at one time, PDF or bound in three-ring binders, indexed in a neat and orderly manner. Partial submittals will not be accepted. Provide four sets of submittal data, unless noted otherwise in Division 01.

1. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet construction schedule, together with any special handling charges, shall be borne by the Contractor.

D. Contractor agrees that shop drawing submittals processed by the engineer are not change orders. The purpose of shop drawing submittals by the Contractor is to demonstrate to the engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. Contractor further agrees that if deviations, discrepancies, or conflicts between shop drawing submittals and contract documents in the form of design drawings and specifications are discovered either prior to or after shop drawings and specifications shall control and shall be followed.

1.11 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.

1.12 PROJECT RECORD DRAWINGS

A. During the process of the work, maintain an accurate record of the installation of the mechanical system, including markups of all deviations from the plans and specifications. Upon completion of the mechanical systems installation, transfer all record data to prints of the original drawings. Drawings shall include all addendum items, change orders, alternations, reroutings, etc. As a condition of acceptance of the project, deliver to the Architect one copy of the record drawings.

1.13 SEISIMIC REQUIREMENTS

A. All systems shall be installed, anchored and braced using OSHPD Pre-Approved (O.P.A.) products, means and methods to comply with Chapter 16 of the Building Code. For any deviations, submit calculations stamped by a licensed structural engineer. This requirement supersedes any conflicting indications contained in the contract documents.

B. All equipment shall be anchored to, pads, floors and wall blocking. Provide welding, tabs, flanges, etc, as necessary for secure installation.

C. Install lateral bracing in all directions, so that no equipment or object can contact another object during a seismic event. Vibrating equipment with flexible connectors shall be anchored with galvanized steel cables. Other equipment shall be anchored with angle-iron or similar material.

D. Use hanger-rod stiffeners for hanger rods (all-thread) longer than 24”.

E. No duct or pipe shall have freedom of movement more than 2” in any direction.

1.14 WARRANTY

A. All materials and equipment shall be new unless otherwise specified.

B. Guarantee all workmanship, materials and equipment and replace any found defective without cost to the Owner, for one year after final acceptance, or as defined in Division 1.

C. Each warranty for longer than the one year described above (that comes with equipment used on the job) shall be passed on to the owner with dates of start and end of the warranty.

PART 2 - PRODUCTS

2.1 EQUIPMENT MANUFACTURER

A. Equipment in the following categories shall be of one manufacturer or available through one manufacturer for each category to facilitate ease of maintenance for the Owner.

1. Plumbing Fixtures & Trim
2. Traps
3. Dielectric Unions
4. Fans
5. Grilles and Diffusers
6. Louvers
7. Dampers
8. Controls

2.2 SUBSTITUTIONS (PRIOR APPROVALS)

A. Bidder's Choice: Materials, equipment or services listed by several identifying names are intended to be bidder's choice, and any of the listed names may be bid without soliciting prior acceptance. Where more than one name is given in the specifications, the first named manufacturer's material, equipment or services is contemplated and any changes and their costs, required to accommodate the other named material or equipment as well as space requirements for the other named materials or equipment, must be assumed by the Contractor in his bid. (See Shop Drawing Requirement)

B. Performance Specification: When any item is specified by requirement to meet a performance, industry or regulating body standard or is specified by a generic specification, (no manufacturers name listed) no prior acceptance by the MECHANICAL ENGINEER is needed except as specifically called for in these specifications.

C. Contractor to be responsible for any changes and costs to accommodate any equipment except the first named in the specification.

D. Substitutions for Material

1. Equipment and materials not listed as equivalents may be proposed as deductive alternates to specified items by submitting it as a separate line item to the base bid on the Bidder's letterhead.
2. Such alternate proposals shall not be substituted for the base bid and must be accompanied by full descriptive data on the proposed equipment, together with a statement of the cost to be deducted for each item and all deviations from specified items. Highlight all difference from specified equipment. If any such alternates are considered, the Contractor shall submit a list of the proposed alternate substitution items within 14 days of award of contract. Late requests for proposed substitutions shall not be accepted by the Engineer due to scheduling or delivery concerns.

PART 3 - EXECUTION

3.1 STORAGE

A. Provide for proper storage of all materials and equipment and assume responsibility for losses due to any cause. All storage shall be within the contact limit lines of the building site. Cover and store all equipment and materials out of elements; any rusted or weather damaged item shall not be used.

3.2 PRODUCT INSTALLATION

A. Manufacturer’s Instructions

1. Except where more stringent requirements are indicated, comply with the product manufacturer’s instructions and recommendations.
2. Consult with manufacturer’s technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect/Engineer in writing and obtain his instruction before proceeding with the work in question.

B. Clearances

1. Install piping and ductwork:

a. Straight and true.
b. Aligned with other work.
c. Close to walls and overhead structure (allowing for insulation).
d. Concealed, where possible, in occupied spaces.

e. Out-of-the-way with maximum passageway and headroom remaining in each space.
f. As high as possible.

2. Do not obstruct windows, doors or other openings.
3. Give the right-of way to piping systems required to slope for drainage (over other service lines and ductwork).
4. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping pipes whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, etc., as required to affect these offsets, transitions and changes in direction.
5. Provide service access per equipment manufacturer's written requirements.

C. Access

1. Install all work to permit removal (without damage to other parts) of coils, heat exchanger bundles, boiler tubes, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts which might require periodic replacement or maintenance. Arrange pipes, ducts, and equipment to permit ready access to valves, traps, starters, motors, control components and to clear the openings of doors and of access panels.

3.3 PROTECTION OF WORK AND PROPERTY

A. Where there are existing facilities, be responsible for the protection thereof, whether or not such facility is to be removed or relocated. Moving or removing any facility must be done so as not to cause interruption of the work of Owner's operation.

B. Close all pipe and duct openings with caps or plugs during installation. Cover all fixtures and equipment and protect against injury. At the final completion, clean all work and deliver in an unblemished condition, or refinish and repaint at the discretion of the Architect.

C. Any equipment, duct or piping systems found to have been damaged or contaminated above "MILL" or "SHOP" conditions shall be replaced or cleaned to the Engineer's satisfaction.

D. Initial fill of traps

1. Provide initial water seal fill for all waste p-traps, condensate traps, or similar traps.

3.4 PROTECTION OF POTABLE WATER SYSTEMS

A. All temporary water connections shall be made with an approved, USC Listed reduced pressure backflow preventer.

B. All hose bibbs shall have, as a minimum, an ASSE 1017 UPC Listed vacuum breaker.

C. Direct connections to hydronic systems shall only be made through a USC Listed reduced pressure back flow preventer.

3.5 ASBESTOS

A. The identification and/or abatement of asbestos hazards is not part of this contract.

1. If asbestos is encountered, contact Owner for instructions.

3.6 DEMONSTRATION

A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings and Operation and maintenance Manual submittal and systems demonstration.

1. Demonstrate that each system operates properly.
2. Explain the operation of each system to the Owner's Representative. Explain use of O&M manual in operating and maintaining systems.

B. Date and time of demonstration will be determined by the Owner.

3.7 CONCRETE

A. All poured in place concrete shall be furnished under the Architectural Divisions of these Specifications.

B. Contractor shall coordinate all requirements for concrete surrounding buried duct. Ducts shall be tied down to concrete deadman and completely surrounded with 3" of concrete.

3.8 ELECTRICAL EQUIPMENT AND WIRING FOR MECHANICAL DIVISION

A. Unless otherwise indicated, all motors and controls shall be furnished, set in place and wired in accordance with the following schedule.

1. Control Voltage (under 50V) shall be furnished and wired by MC.
2. Over 50V, all motors and controls shall be furnished by MC, set in place by MC, wired by EC.
3. Control devices furnished by Mechanical and wired by Electrical shall be located at the device being controlled, unless indicated otherwise, or mutual agreement is made between the contractors with no change in the contract price.
4. If furnished as part of factory wired equipment, wiring and connections only by ED.
5. Wiring from alarm contacts to alarm system by ED; all control function wiring by MD.

6. The above list does not attempt to include all components. All items necessary for a complete system shall be included in the base contract.
7. Connections to all controls directly attached to ducts, piping and mechanical equipment shall be made with flexible connectors.
8. ALL CONTROL WIRING SHALL BE IN METALLIC RACEWAYS. RACEWAYS, CONDUITS, TRAYS, TUBES, ETC SHALL BE PROVIDED BY EC AT THE DIRECTION OF MC. MC IS RESPONSIBLE TO FULLY COMMUNICATE AND COORDINATE THIS REQUIREMENT PRIOR TO BID AND DURING CONSTRUCTION.
9. All control wiring in mechanical rooms shall be in metallic raceways.

3.9 FLUSHING, CLEANING & STERILIZING

A. Before final connections are made in the piping systems, blow out all piping with air and then wash out with cleaning compounds. Then flush the system to remove of all foreign materials. Furnish all temporary connections, valves, etc, required for this purpose. Clean the boiler and chiller by the same procedure.

B. Flush both domestic hot and cold water systems with hot water to remove residual soldering flux.

C. After flushing, sterilize the domestic water system.

3.10 TESTING

A. Perform all tests required by governing authorities. Notify inspector prior to all tests.

B. Test all drain and waste lines with standing water test of twelve feet of head, held long enough to visually inspect each joint.

C. Test all gas piping under 60 psig air pressure.

D. All tests must be done to the satisfaction of the local authorities having jurisdiction, before covering.

E. All hydrostatic tests to be held for a minimum of six hours without loss of pressure. Air tests to be held for a minimum of two hours without loss of pressure.

F. Furnish all instruments required for testing.

3.11 PLACING IN OPERATION

A. Clean all ducts, pipes, equipment, controls etc., of plaster and other foreign debris.

B. Before final acceptance, clean or replace all strainers, oil or grease all bearings and clean out all drains. Clean and recoat all permanent filters, replace throwaway type filters with new filters.

C. The systems shall be put into operation.

1. The Contractor shall verify that all controls are set to meet operating conditions specified.
2. The contractor shall verify that all pieces of equipment are operable and that all sequences of control are met.
3. The contractor shall adjust settings through 1st year as requested by mechanical engineer and owner.

3.12 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Books of Operating and Maintenance Instructions shall be personally delivered to the Owner's authorized representative and the Owner shall be instructed as to their use and the equipment involved. (Provide two books).

SECTION 210050—BASIC MATERIALS AND METHODS FOR FIRE-SUPPRESSION, PLUMBING, AND HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Special Conditions and Contract Documents are a part of these specifications. Consult them for further instructions and be governed by the requirements thereunder.

1.2 STANDARDS FOR MATERIALS

A. All materials shall conform to current applicable industry standards. Workmanship and neat appearance shall be as important as the electrical and mechanical operation. Defective or damaged materials shall be replaced or repaired, prior to final acceptance, in a manner acceptable to the Architect or Owner at no additional cost to the Owner.

B. All equipment shall have housings suitable for the location installed.

C. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion, unless specifically directed to reuse any existing materials.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Provide painted, steel access doors with key lock suitable for the surface in which they are installed and satisfactory to the Architect. Recessed style to accept plaster finish, recessed type to accept acoustical tile, flush panel for drywall or flanged flushed panel for remodeling. In installed in fire rated surface, access door to carry proper rating.

2.2 ALTITUDE RATINGS

A. Except as otherwise noted, all equipment capacities, air qualities, etc., are adjusted ratings for the elevation of this project as noted on drawings. Manufacturer’s ratings shall be adjusted to provide net ratings shown.

2.3 FIRE STOPPING MATERIAL

A. Penetrations through rated walls and floors shall be sealed with a material capable of preventing the passage of flames and hot gasses when subjected to the requirements of the test standard specific for fire stops ASTM-E-814. Acceptable materials include: Dow Corning RTV fire stop foam for bare pipe, metal conduit, and electrical cable; 3M fire dam 150 caulk for bare pipe, metal conduit, and building construction gaps; 3M CP-25.

B. Caulk and FS-195 intumescent strips for insulated pipes, plastic pipe or conduit, and electrical cable. Submit UL listed application data for each type of penetration encountered.

PART 3 - EXECUTION

3.1 FREEZE PROTECTION

A. Proximity of any equipment component or fluid piping to potential damage from freezing sources shall be avoided wherever possible. Drawings are diagrammatic. Make location adjustments, add insulation and/or control devices and/or heat sources as necessary to prevent or minimize freeze damage potential. The Architect/Engineer will neither guarantee nor be responsible for any consequences of freezing.

3.2 PIPE DEPTHS

A. Interior pipe below slabs shall be a minimum of 4 inches below slab and shall not be in contact with concrete at any point. Minimum exterior cover over water piping, unless otherwise shown or required by code, shall be 4 feet above the top of the pipe. Area drains shall have maximum cover possible consistent with finished landscape and acceptable flow lines. Gas piping shall have minimum of 3 foot cover with warning tape 12" above pipe. Sanitary waste and storm drain lines shall have 2 foot cover minimum.

3.3 PIPE AND PIPE FITTINGS

A. Full-length pipe in longest lengths possible shall be used. All threads shall be right hand, pipe standard, clean cut, full depth and tapering. Install piping so as to permit complete draining. Provide drains at all low points. All interior soil, waste and condensate lines shall have uniform pitch in the direction of flow of not less than 1/4 inch per foot unless otherwise noted. Ream out all pipe ends, turn on ends and rattle before installing.

3.4 CLEANING

A. Intent: It is the intent of this specification to require that all work, including the inside of equipment, be left in a clean condition with all dust, grease, and construction debris removed.

B. Piping and connected equipment to be left free of sediments, core sand, grease, etc.

C. Clean all exposed surfaces of piping, ducts and hangers, etc., sufficiently to receive paint. Vacuum ducts as required for debris removal.

D. Remove and clean all screens, interceptors, strainers, etc., in piping systems just prior to substantial completion.

E. Clean and wipe dry all plumbing fixtures, exposed valves, faucets, and piping, etc. that are exposed just prior to substantial completion. Clean all equipment and fixtures per manufacturer's specifications to avoid scratching finished surfaces. Leave all plumbing fixtures ready to use.

F. Clean interior and exterior of all air handling equipment of all construction debris. Clean exterior of all exposed ductwork just prior to substantial completion.

G. Thoroughly clean all equipment room floors after completion of equipment, pipe and duct cleaning. A condition of final acceptance will be the cleanliness of all exposed systems, equipment, and equipment rooms.

3.5 EXPANSION COMPENSATION AND SEISMIC PROTECTION

A. Examine piping layout and provide anchors or expansion joints required to adequately protect system.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.

C. Accomplish structural work and provide equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints, and provide corrugated bellows type expansion joints where required.

D. Provide seismic bracing as required by code for all ducts, piping and equipment.

3.6 SLEEVES, CUTTING, PATCHING

A. Major openings in the structure for mechanical work may be shown on the structural drawings; these will be done under the Architectural Division of these Specifications. It is the Contractor's responsibility to set necessary sleeves and boxes for pipe and ducts (not shown on the structural drawings) before erection of structure. This Contractor is responsible for the correct size and location of all openings including coordination with the other trades. All sleeves shall be large enough to allow for continuous insulation to pass through the sleeve.

B. In mechanical equipment room floors, all pipe sleeves to the Schedule 40 pipe and shall extend 1" above finished floor. In mechanical equipment room floors, all ducts shall have a 4" high concrete curb around duct.

C. Caulk all pipes and ducts leaving equipment rooms between sleeve and duct or pipe, 1" deep on each side of wall, floor, or roof. Caulk bare pipes and ducts with lead wool. Caulk insulated pipes with 1- or 2-part polysulphide caulking compound.

D. In the same manner as described in Paragraph C above, caulk all other pipes and ducts throughout the building which penetrate walls and floors and roofs this includes pipe and ducts to rooftop units.

E. All pipes which may be in view shall be finished with chrome floor, wall and ceiling plates, except in equipment rooms.

3.7 EXCAVATION AND BACKFILL

A. Excavation, trenching, bedding of pipe, placement and cover, backfilling, etc., in conjunction with work under this Division, shall be per requirements of Division 2 and the additional requirements specified herein.

B. Trenches: Slope bottoms uniformly to drain. Trench bottoms to be firm, free from large rocks or boulders, or shall have concrete cradles placed to support piping. Cradles to bear on undisturbed soil.

C. Cast iron: Place on firm trench bottom shaped to accept hubs. Both hubs and pipe shall have uniform firm bearing. Place a minimum of 12 inches of loose rock-free material over pipe.

D. Other piping, conduits, culverts: Place on firm trench bottom and backfill per Division 2 and 15 or embed per manufacturer's recommendations.

E. Compaction

1. Backfill by hand around the pipe and the first 12" over the top of the pipe. Moisten, backfill, and tamp in 8" layers (maximum) with air motor or gasoline driven tamper to consolidate to 90% of the maximum density obtainable at optimum moisture content. (Puddling will not be allowed).
2. Trenches under road surfacing shall have the upper 6" layer, forming the subgrade for pavement compacted to at least 95% of the maximum density obtainable at optimum moisture content for rigid pavements.
3. Density of backfill shall be determined by the requirements of the A.A.S.H.O. in Pamphlet 57. Standard Method T-99-57.
4. Where requirements of the general conditions are more stringent than the above, the general condition requirements shall be met.

F. Pavement

1. Accomplish cutting of flexible pavement so that the remaining exposed edge of the pavement conforms vertically and horizontally to a straight line. The width of the section of pavement removed shall be of necessary width for the proper laying of pipe, but shall not exceed 36". Waste material resulting from the above operations will be disposed of in suitable waste areas. Repair pavement to satisfaction of the authorities having jurisdiction.

G. Shoring

1. Provide all shoring required to perform the excavation and to protect the project, employees, and public.

3.8 FOUNDATIONS AND SUPPORTS

A. Furnish and install as indicated on the plans and/or as may be necessary for the proper installation of all equipment furnished under this Division, all foundations, bases and supports. Contractor shall be responsible for their correct location and sizes to fit all equipment. Shim and grout between the equipment and its base to align and level. Bolt equipment inertia bases, vibration isolators, and supports to prevent relative movement.

B. Furnish all hangers, anchors, sway bracing, guides, etc., for the various piping and duct systems as required for their proper installation.

END OF SECTION

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Comply with 210518

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

END OF SECTION 210518

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Comply with 220529.

1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

END OF SECTION 210548

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Sprinklers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer or NICET 3 technician responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

B. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

    a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET 3 Technician.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Contact Airport District's Civil Engineer for available fire-hydrant flow test records. Airport District's water main is on a campus system, downstream from the Water District's backflow and meter system.
2. Provide larger-sized piping to accommodate low residual pressure conditions.
3. Sprinkler system design shall be approved by authorities having jurisdiction.

    a. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
    b. Sprinkler Occupancy Hazard Classifications:

        1) Automobile Parking Areas: Ordinary Hazard, Group 1.
        2) Building Service Areas: Ordinary Hazard, Group 1.
        3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
        4) General Storage Areas: Ordinary Hazard, Group 1.
        5) Machine Shops: Ordinary Hazard, Group 2.
        6) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
        7) Repair Garages: Ordinary Hazard, Group 2.

4. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
    b. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.

5. Maximum Protection Area per Sprinkler: According to UL listing.

6. Maximum Protection Area per Sprinkler:

    a. Storage Areas: 130 sq. ft..
    b. Mechanical Equipment Rooms: 130 sq. ft..
    c. Electrical Equipment Rooms: 130 sq. ft..
    d. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, , . Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, ; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Grooved-Joint, Steel-Pipe Appurtenances:

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

    a. Anvil International.
    b. Corcoran Piping System Co.
    c. National Fittings, Inc.
    d. Shurjoint Piping Products.
    e. Smith-Cooper International.
    f. Tyco Fire & Building Products LP.
    g. Victaulic Company.

2. Pressure Rating: 175-psig minimum.
3. Painted Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

E. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Victaulic Company.

2.3 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

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

    a. Anvil International.
    b. National Fittings, Inc.
    c. Shurjoint Piping Products.
    d. Tyco Fire & Building Products LP.

2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

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

    a. AGF Manufacturing Inc.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

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

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175 psig .
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

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

a. AGF Manufacturing Inc.
b. Triple R Specialty.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

2.4 SPRINKLERS

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

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire & Building Products LP.
4. Venus Fire Protection Ltd.
5. Victaulic Company.
6. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

D. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

E. Sprinkler Finishes: bronze.

F. Sprinkler Guards:

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

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install sprinkler piping with drains for complete system drainage.

H. Install alarm devices in piping systems.

I. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

J. Fill sprinkler system piping with water.

K. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.2 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

3.4 SPRINKLER INSTALLATION

A. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
3. Coordinate with fire-alarm tests. Operate as required.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

3.7 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4 , shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with cut- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with cut- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.9 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Wall Mounting: Sidewall sprinklers.
3. Spaces Subject to Freezing: Sidewall, dry sprinklers.
4. Special Applications: .

END OF SECTION 211313

SECTION 220010 – GENERAL PROVISIONS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with 210010.

B. Comply with 210050.

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 2 - GENERAL

2.1 SUMMARY

A. Section Includes:

1. Escutcheons.

2.2 ACTION SUBMITTALS

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

PART 3 - PRODUCTS

3.1 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 4 - EXECUTION

4.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

4.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze ball valves.

PART 2 - PRODUCTS

2.1 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

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

a. Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts; a Watts Water Technologies company.
h. Zurn Industries, LLC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig .
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze ball valves, two-piece with full port and bronze or brass trim.

3.4 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze ball valves, two-piece with full port and bronze or brass trim.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION 220523.12

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

C. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for .

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel and attachments for general service applications.

F. Use copper-plated pipe hangers and attachments for copper piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
3. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe labels.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PIPE LABELS

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

1. Actioncraft Products, Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Identification Systems.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.

B. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:

   a. Background: Safety blue.
   b. Letter Colors: White.

3. Domestic Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

4. Natural Gas Piping:

   a. Background Color: Safety yellow.
   b. Letter Color: Black.

END OF SECTION 220553

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with NSF Standard 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples:

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

   a. Elster Perfection Corporation.
   b. Grinnell Mechanical Products.
   c. Matco-Norca.
   d. Precision Plumbing Products.
   e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install domestic water piping level without pitch and plumb.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

3.8 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.

B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.9 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall hydrants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 WALL HYDRANTS

A. Moderate-Climate Wall Hydrants :

1. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig .
3. Operation: Metal Handle.
4. Inlet: NPS 3/4 or NPS 1 .
5. Outlet:
    a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7.
6. Nozzle and Wall-Plate Finish: Rough bronze.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

2.2 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of waste piping in direction of flow is prohibited.

G. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

H. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

J. Install underground PVC piping according to ASTM D 2321.

K. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
2. Install drains in sanitary waste gravity-flow piping.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 : 60 inches with 3/8-inch rod.
2. NPS 3 : 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5 : 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches .

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water .
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg .
    b. Air pressure must remain constant without introducing additional air throughout period of inspection.
    c. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.8 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

B. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.

1.2 DEFINITIONS

A. PVC: Polyvinyl chloride.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Floor Cleanouts :

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

    a. Josam Company.
    b. Oatey.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Tyler Pipe; a subsidiary of McWane Inc.
    f. Watts; a Watts Water Technologies company.
    g. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Inside calk.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with .

9. Frame and Cover Material and Finish: Rough bronze.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 . Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. Install deep-seal traps on floor drains and other waste outlets, if indicated.

D. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trench drains.

1.2 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. HDPE: High-density polyethylene.

C. PE: Polyethylene.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 TRENCH DRAINS

A. Trench Drains :

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.
    d. Watts; a Watts Water Technologies company.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchor.
5. Clamping Device: Not required.
6. Grate Material: Ductile iron or gray iron.
7. Grate Finish: Painted.
8. Top Loading Classification: Heavy Duty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.
2. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 150 psig or less.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pressure regulators. Include rated capacities and operating characteristics.
2. Filters. Include rated capacities and operating characteristics.
3. Lubricators. Include rated capacities and operating characteristics.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.

1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Copper Tube: ASTM B 88, Type K or L seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.

1. ASME B16.21, nonmetallic, flat, full-face, asbestos free, 1/8-inch maximum thickness.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.3 VALVES

A. Metal Ball Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping."Plumbing Piping."

2.4 DIELECTRIC FITTINGS

A. Dielectric Unions: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

2.5 FLEXIBLE PIPE CONNECTORS

A. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: 200 psig minimum.
2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.

2.6 SPECIALTIES

A. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

B. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

2.7 QUICK COUPLINGS

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

1. Aeroquip Corporation; Eaton Corp.
2. Bowes Manufacturing Inc.
3. Foster Manufacturing, Inc.
4. Milton Industries, Inc.
5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
6. Rectus Corp.
7. Schrader-Bridgeport; Amflo Div.
8. Schrader-Bridgeport/Standard Thomson.
9. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
10. TOMCO Products Inc.
11. Tuthill Corporation; Hansen Coupling Div.

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.

1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
2. Plug End: Straight-through type with barbed outlet for attaching hose.

2.8 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.

1. Hose: Reinforced single- or double -wire-braid, CR-covered hose for compressed-air service.
2. Hose Clamps: Stainless-steel clamps or bands.
3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:

1. NPS 2 and Smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
2. NPS 2 and Smaller: Type K or L, copper tube; wrought-copper fittings; and brazed joints.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping adjacent to equipment and machines to allow service and maintenance.

E. Install air and drain piping with 1 percent slope downward in direction of flow.

F. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

G. Equipment and Specialty Flanged Connections:

1. Use steel companion flange with gasket for connection to steel pipe.
2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

H. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

I. Install piping to permit valve servicing.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Apply appropriate tape or thread compound to external pipe threads.

D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

E. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping."

B. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

C. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric unions in piping at connections of dissimilar metal piping and tubing.

3.6 SPECIALTY INSTALLATION

A. Install quick couplings at piping terminals for hose connections.

B. Install hose assemblies at hose connections.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Vertical Piping: MSS Type 8 or 42, clamps.

C. Individual, Straight, Horizontal Piping Runs:

1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

E. Support horizontal piping within 12 inches of each fitting and coupling.

F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

G. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
3. NPS 1-1/2: 12 feet with 3/8-inch rod.
4. NPS 2: 13 feet with 3/8-inch rod.

H. Install supports for vertical, Schedule 40, steel piping every 15 feet.

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

3.8 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:

1. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
2. Repair leaks and retest until no leaks exist.
3. Inspect filters lubricators and pressure regulators for proper operation.

END OF SECTION 221513

SECTION 230010 – GENERAL PROVISIONS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Comply with 210010.

B. Comply with 210050.

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 2 - GENERAL

2.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

2.3 ACTION SUBMITTALS

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

PART 3 - PRODUCTS

3.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

3.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Corrugated stainless-steel tubing with polymer coating.
3. Operating-Pressure Rating: 0.5 psig.
4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches

3.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

3.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

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

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.

7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Lee Brass Company.
   b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

3.5 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

B. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Pacific Seismic Products, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 7 psig.
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller.

PART 4 - EXECUTION

4.1 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

4.2 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Locate valves for easy access.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Verify final equipment locations for roughing-in.

I. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

J. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

K. Connect branch piping from top or side of horizontal piping.

L. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

M. Do not use natural-gas piping as grounding electrode.

N. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

4.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install earthquake valves aboveground outside buildings according to listing.

4.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

4.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping.

B. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

4.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

4.7 LABELING AND IDENTIFYING

A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

4.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

4.9 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

4.10 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Bronze plug valve.

END OF SECTION 231123

SECTION 235523.16 - HIGH-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. High-intensity, infrared, gas-fired, radiant heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.

a. Ceramic Tiles: Five years.
b. Heater Components: Three year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ANSI Z83.19A/CSA 2.35A.

1. CSA certified, with CSA Seal and certification number clearly visible on units.
2. UL listed and labeled, with UL label clearly visible on units.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 HIGH-INTENSITY, INFRARED, GAS-FIRED, RADIANT HEATERS

A. Factory-assembled, indoor, overhead-mounted, electrically controlled, high-intensity, infrared, radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

B. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Ignition:

1. Direct Spark: 24/25-V ac, solid-state ignition module with spark electrode and flame sensor.

D. Accessories:

1. Protective screen and heat-deflector shield.
2. Stainless-steel flexible connector with manual valve for gas supply.
3. Rigid mounting kits.

2.3 CONTROLS AND SAFETIES

A. Thermostat: Single-stage, wall-mounted type with 40 to 60 deg F operating range and fan on switch.

1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.

B. Suspended Units: Mount to substrate using rigid mounting kits or brackets, supplied by manufacturer or manufactured.

C. Maintain manufacturers' recommended clearances for combustibles.

D. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.

E. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

F. Electrical Connections: Comply with applicable requirements in Electrical Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

G. Adjust initial-temperature set points.

H. Adjust burner and other unit components for optimum heating performance and efficiency.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Test heat output.

B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

END OF SECTION 235523.16

SECTION 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited except where specifically noted.

1.2 MINIMUM REQUIREMENTS

A. The California Building Code (CBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

C. In no case shall construction where drawings or specifications conflict with above codes and standards be performed; any conflicts shall be immediately be brought to Engineer for resolution.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which

are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:
   1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
   2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
   3. Certified: Materials and equipment which:
      a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
      b. Are periodically inspected by a NRTL.
      c. Bear a label, tag, or other record of certification.
   4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:

1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
2. The Owner reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
   1. The Owner shall have the option of witnessing factory tests. The Contractor shall notify the Owner through the Engineer a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
   2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the Engineer fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
   3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and shall be witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Owner to witness factory re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Owner or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the Engineer.
   4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be allowed for the required work, the following requirements are mandatory:
   1. The Contractor must complete a short circuit analysis and arc flash study to characterize the potential fault current and caloric energy levels in the work area. Assuming the energy levels are low enough to allow protective equipment to be effective, electricians shall use full coverage, appropriate, protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on the identified and characterized energized systems in accordance with NFPA 70E.
   2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the Engineer. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
   3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Engineer.
   4. If arc flash energy cannot be sufficiently mitigated or protected against, an alternate plan for turning off power must be developed by the Contractor..

D. For work that affects existing electrical systems, plan, arrange and perform work such that there is minimal interference with normal functioning of the facility.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC and required by serving utility.

C. Inaccessible Equipment:

1. Where the Owner determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements and project plans if they have provided them. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with machine screws in tapped holes.

C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
   1. Nominal system voltage.
   2. Arc flash boundary (inches).
   3. Available arc flash incident energy at the corresponding working distance (calories/cm2).
   4. Required PPE category and description.
   5. Limited approach distance (inches), restricted approach distance (inches).
   6. Equipment/bus name, date prepared, and manufacturer name and address.

   Update the above requirements as necessary to conform with latest updates to NFPA 70E.

1.12 SUBMITTALS

A. Submit to the Engineer SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Owner's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Owner to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data

sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.

2. Equipment structure and anchoring shall be designed to be seismically adequate, to not be damaged or moved to the point of becoming inoperable due to a seismic event of the magnitude predicted by C.B.C. for the site. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.//
3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.

e. Safety precautions for operation and maintenance.
f. Diagrams and illustrations.
g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
h. Performance data.
i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the Engineer with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.15 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Owner.
C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Owner.

1.16 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Owner.

1.17 INSTRUCTION

A. Instruction to designated Owner personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.
C. A training schedule shall be developed and submitted by the Contractor and approved by the //Engineer at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

--- END of SECTION ---

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
    a. Submit sufficient information to demonstrate compliance with drawings and specifications.

b. Submit the following data for approval:
   1) Electrical ratings and insulation type for each conductor and cable.
   2) Splicing materials and pulling lubricant.

2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10 ..... Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-10 ..... Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-10 ..... Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-09 ..... Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-10 ..... Thermoset-Insulated Wires and Cables

83-08 ..... Thermoplastic-Insulated Wires and Cables

467-07 ..... Grounding and Bonding Equipment

486A-486B-03 ..... Wire Connectors

486C-04 ..... Splicing Wire Connectors

486D-05 ..... Sealed Wire Connector Systems

486E-09..... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-04..... Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.

B. All conductors shall be copper unless specifically indicated otherwise in the drawings.

C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Direct Burial Cable: UF or USE cable.

E. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange

Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the Engineer.
7. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped conductors.
   3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
   1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.
   4. All bolts, nuts, and washers used with splices shall be //zinc-plated//cadmium-plated// steel.

D. Above Ground Splices for 250 kcmil and Larger:
   1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

E. Underground Splices for No. 10 AWG and Smaller:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

F. Underground Splices for No. 8 AWG and Larger:
1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.//

G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be //zinc-plated//cadmium-plated// steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be sized such that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
B. Install all conductors in raceway systems.
C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
H. Use only a non-hardening duct-seal to seal conduits entering a building, after installation of conductors. Any other material shall be pre-approved prior to use.
I. Conductor and Cable Pulling:
    1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
    2. Use nonmetallic pull ropes.
    3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
    4. All conductors in a single conduit shall be pulled simultaneously.

5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. No more than three branch circuits shall be installed in any one conduit.

K. When stripping stranded conductors, correctly use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

B. Fireproofing (where applicable):

1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.
2. Use fireproofing tape as specified in Section 26 05 13, MEDIUM-VOLTAGE CABLES, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a calibrated torque screwdriver or wrench.

B. Where the Owner determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Owner.

3.4 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass or stainless steel tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused. They shall be removed.

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings. If external power is used, use only a listed Class 2 power supply for signaling/control connection to contacts in motor controllers, or use the motor controller's control power to feed switched power to a relay or input outside the motor controller.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.
B. Identifying numbers and letters on the wire markers shall correspond to those approved in submitted wiring diagrams used for installing the systems.
C. Wire markers shall retain their markings after cleaning.
D. In each manhole and handhole, install embossed brass or stainless steel tags to identify the system served and function.

3.9 DIRECT BURIAL CABLE INSTALLATION

A. Tops of the cables:
    1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown or required by NEC.
    2. Below road and other pavement surfaces: In conduit as specified, minimum 760 mm (30 inches) unless greater depth is shown or required by NEC.
    3. Do not install cables under railroad tracks.

B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on drawings, but not less than 50 mm (2 inches) trade size with bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.
C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.
D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
   1. Place 75 mm (3 inches) bedding sand in the trenches before installing the cables.
   2. Place 75 mm (3 inches) shading sand over the installed cables.
E. Provide horizontal slack in the cables for contraction during cold weather.
F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
G. Connections and terminations shall be listed submersible-type designed for the cables being installed.
H. Warning tape shall be continuously placed 300 mm (12 inches) above the buried cables.

3.10 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests: Inspect physical condition.
   2. Electrical tests:
      a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
      b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
      c. Perform phase rotation test on all three-phase circuits.

--- END OF SECTION ---

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. “Grounding electrode system” refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary and lightning protection system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low-voltage switchgear.

E. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.

F. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

a. Submit sufficient information to demonstrate compliance with drawings and specifications.
b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.

2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the Engineer.
3. Certifications:
   a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):
   B1-07 ..... Standard Specification for Hard-Drawn Copper Wire
   B3-07 ..... Standard Specification for Soft or Annealed Copper Wire
   B8-11 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   81-83..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):
   70-11..... National Electrical Code (NEC)(California Electrical Code)
   70E-12..... National Electrical Safety Code
   99-12..... Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):
   44-10 ..... Thermoset-Insulated Wires and Cables
   83-08 ..... Thermoplastic-Insulated Wires and Cables
   467-07 ..... Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings or not less than required by the NEC or not less than that required to limit voltage drop (VD) to 2.5% or less at full load, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2 GROUND RODS

A. Copper clad steel or stainless steel, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.

B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance of 25ohms or less.

2.3 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode (Ufer) shall be No. 4 AWG bare copper wire or as shown in the drawings, installed per NEC.

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
5. In all cases, coatings (paint) shall be removed beneath mechanically fastened connections..

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with //zinc-plated//cadmium-plated// steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.

B. System Grounding:

1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes: Provide an insulated equipment grounding stranded conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.

C. Pad-Mounted Transformers:

1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
2. Ground the secondary neutral.

D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
   2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:
   1. Connect the equipment grounding conductors to the ground bus.
   2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:
   1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
   2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system /or to the ground bar at the service equipment whichever offers lowest ground resistance.

3.5 RACEWAY

A. Conduit Systems:
   1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
   2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.

3. Metallic conduit that only contains a grounding conductor that is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.
5. Metallic conduits which terminate with a mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with insulated throat grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper (or NEC size if larger) at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions. Use larger gauge if required by NEC.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.
I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

A. Fences shall be grounded as shown on the drawings. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post if so shown in drawings or required in specifications.
B. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375 inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.7 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM (IF PRESENT)

A. Bond the lightning protection system to the electrical grounding electrode system.

3.10 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.11 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed **5** ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Owner. Final tests shall ensure that this requirement is met.
B. Grounding system resistance shall comply with or be lower than the electric utility company ground resistance requirements.

3.12 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.
B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.
C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors, rated for installation location.
D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.13 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the Engineer prior to backfilling. The Contractor shall notify the Engineer 24 hours before the connections are ready for inspection.

--- END of SECTION---

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

C. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
    a. Size and location of main feeders.
    b. Size and location of panels and pull-boxes.
    c. Layout of required conduit penetrations through structural elements.
    d. Submit the following data for approval:
        1) Raceway types and sizes.

2) Conduit bodies, connectors and fittings.
3) Junction and pull boxes, types and sizes.

2. Certifications: Two weeks prior to final inspection, submit the following:
   a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American National Standards Institute (ANSI):
C80.1-05 ..... Electrical Rigid Steel Conduit
C80.3-05 ..... Steel Electrical Metal Tubing
C80.6-05 ..... Electrical Intermediate Metal Conduit

C. National Fire Protection Association (NFPA):
70-11..... National Electrical Code (NEC)(California Electrical Code)

D. Underwriters Laboratories, Inc. (UL):
1-05..... Flexible Metal Conduit
5-11..... Surface Metal Raceway and Fittings
6-07..... Electrical Rigid Metal Conduit - Steel
50-95..... Enclosures for Electrical Equipment
360-13..... Liquid-Tight Flexible Steel Conduit
467-13..... Grounding and Bonding Equipment
514A-13..... Metallic Outlet Boxes
514B-12..... Conduit, Tubing, and Cable Fittings
514C-07 ..... Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-11..... Schedule 40 and 80 Rigid PVC Conduit and Fittings
651A-11..... Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07..... Electrical Metallic Tubing

1242-06 ..... Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):

TC-2-13 ..... Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-13 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-12 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-13 ..... Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-12 ..... Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

F. American Iron and Steel Institute (AISI):

S100-2007..... North American Specification for the Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.
3. Where required, rigid aluminum: shall conform to UL 6A and ANSI C80.5.
4. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
5. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
6. Flexible Metal Conduit: Shall conform to UL 1.
7. Liquid-tight Flexible Metal Conduit (LFMC): Shall conform to UL 360.
8. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (HDPE).

9. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:
   1. Rigid Steel and Intermediate Metallic Conduit Fittings:
      a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
      b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
      c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
      d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted. Use bonding bushings unless specifically not required.
      e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
      f. Sealing Fittings (Boundary Seals): Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
   2. Rigid Aluminum Conduit Fittings (If used):
      a. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4% copper are prohibited.
      b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
      c. Set Screw Fittings: Not permitted for use with aluminum conduit.//
   3. Electrical Metallic Tubing Fittings:
      a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
      b. Only steel or malleable iron materials are acceptable.

c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
d. Setscrew Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.
e. Indent-type connectors or couplings are prohibited.
f. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

4. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
5. Liquid-tight Flexible Metal Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Liquid-tight Flexible Non-metallic Conduit Fittings (LFNC) (where allowed or required):
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Complete connector systems from a single manufacturer are acceptable.
   c. System shall incorporate ground bonding conductor, plastic compression ring, and a gland for tightening.
7. Direct Burial Plastic Conduit Fittings: Fittings shall meet the requirements of UL 514C and NEMA TC3.
8. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
9. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:

1. UL-50 and UL-514A.
2. Rustproof cast metal where required by the NEC or shown on drawings.
3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the Engineer prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the Engineer where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.
B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.
C. Install conduit as follows:
    1. In completed, mechanically and electrically continuous, runs finished prior to pulling in cables or wires.
    2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
    3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
    4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
    5. Cut conduits square, ream, remove burrs, and draw up tight.
    6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings. Support EMT smaller than 1” and PVC smaller than 1.25” 3’ o.c.
    7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
    8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
    9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
    10. Conduit installations under fume and vent hoods are prohibited.

11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
14. Do not use aluminum conduits in wet locations.

D. Conduit Bends:
   1. Make bends with standard conduit bending machines.
   2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
   3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
   1. Install conduit with wiring, including homeruns, as shown on drawings.
   2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the Engineer.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
   1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
   2. Align and run conduit in direct lines.
   3. Install conduit through concrete beams only:
      a. Where shown on the structural drawings.
      b. As approved by the Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
   4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
      a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for Conductors Above 600 V: Rigid steel or rigid aluminum. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.
6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.
B. Conduit for Conductors Above 600 V: Rigid steel or rigid aluminum. Mixing different types of conduits in the system is prohibited.
C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits in the system is prohibited.
D. Align and run conduit parallel or perpendicular to the building lines.
E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals. Support EMT under 1” and PVC under 1.25” at 3’o.c.
G. Surface Metal Raceways: Use only where shown on drawings.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless shown otherwise on drawings.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation or shall be factory vinyl coated (with matching coated fittings). After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.8 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down

operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.9 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper bonding jumper installed.

3.10 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:
    a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
    b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
    c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:
    1. Flush-mounted.
    2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary. Size boxes per NEC requirements, minimum.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - END of SECTION - - -

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast manholes and pullboxes to form a complete underground electrical raceway system.

B. The terms “duct” and “conduit” are used interchangeably in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts, manholes, and pullboxes with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
    a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    b. Submit information on manholes, pullboxes, ducts, and hardware. Submit manhole plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories.

c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes, pullboxes, or duct banks at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit to the Engineer for approval prior to construction.

2. Certifications: Two weeks prior to the final inspection, submit the following.
   a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete
318-11/318M-11 ..... Building Code Requirements for Structural Concrete & Commentary
SP-66-04 ..... ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-10 ..... Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478-12 ..... Standard Specification for Precast Reinforced Concrete Manhole Sections
C858-10e1 ..... Underground Precast Concrete Utility Structures
C990-09 ..... Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2-03 ..... Electrical Polyvinyl Chloride (PVC) Conduit
TC 3-04 ..... Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing
TC 6 & 8-03 ..... Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations

TC 9-04 ..... Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)(California Electrical Code)

70E-12 ..... National Electrical Safety Code

G. Underwriters Laboratories, Inc. (UL):

6-07 ..... Electrical Rigid Metal Conduit-Steel

467-07 ..... Grounding and Bonding Equipment

651-11 ..... Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

651A-11 ..... Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

651B-07 ..... Continuous Length HDPE Conduit

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE MANHOLES AND HARDWARE

A. Structure: Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole.

B. Cable Supports:

1. Cable stanchions shall be hot-rolled, heavy duty, hot-dipped galvanized "T" section steel, 56 mm (2.25 inches) x 6 mm (0.25 inch) in size, and punched with 14 holes on 38 mm (1.5 inches) centers for attaching cable arms.
2. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot-dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.
3. Insulators for cable supports shall be porcelain, and shall be saddle type or type that completely encircles the cable.
4. Equip each cable stanchion with one spare cable arm, with three spare insulators for future use.

C. Ladder: Aluminum or Fiberglass with 400 mm (16 inches) rung spacing. Provide securely-mounted ladder for every manhole over 1.2 M (4 feet) deep.

D. Ground Rod Sleeve: Provide a 75 mm (3 inches) PVC sleeve in manhole floors so that a driven ground rod may be installed.

E. Sump: Provide 305 mm x 305 mm (12 inches x 12 inches) covered sump frame and grated cover.

2.2 PULLBOXES

A. General: Size as indicated on the drawings, but in no case smaller than required by NEC. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of the appropriate ANSI 77,/Tier 5, Tier 8, Tier 15 or Tier 22 loading. Provide pulling irons, 22 mm (0.875 inch) diameter galvanized steel bar with exposed triangular-shaped opening.

B. Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both. Pullbox shall have open bottom.

C. Fiberglass Pullboxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Concrete Pullboxes: Shall be monolithically-poured reinforced concrete.

A. Number and sizes shall be as shown on the drawings.

B. Ducts (concrete-encased):
   1. Plastic Duct:
      a. NEMA TC6 & 8 and TC9 plastic utilities duct, UL 651 and 651A Schedule 40 PVC conduit.
      b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.
   2. Conduit Spacers: Prefabricated plastic.

C. Ducts (direct-burial):
   1. Plastic duct:
      a. NEMA TC2 and TC3, UL 651, 651A, and 651B, Schedule 40 PVC or HDPE conduit Schedule 80 PVC or HDPE conduit as shown in the drawings.
      b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.
   2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape or factory vinyl coated with matching fittings.

2.4 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.5 WARNING TAPE

A. 4-mil polyethylene 75 mm (3 inches) wide detectable tape, red with black letters, imprinted with “CAUTION - BURIED ELECTRIC CABLE BELOW” or similar.

2.6 PULL ROPE FOR SPARE DUCTS

A. Plastic with 890 N (200 lb) minimum tensile strength.

PART 3 - EXECUTION

3.1 MANHOLE AND PULLBOX INSTALLATION

A. Assembly and installation shall be per the requirements of the manufacturer.
   1. Install manholes and pullboxes level and plumb.
   2. Units shall be installed on a 300 mm (12 inches) thick level bed of 90% compacted granular fill, well-graded from the 25 mm (1 inches) sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.

B. Access: Ensure the top of frames and covers are flush with finished grade.

C. Grounding in Manholes:
   1. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 100 mm (4 inches) above the manhole floor.
   2. Install a No. 3/0 AWG bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
   3. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
   4. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG bare copper jumper using an exothermic welding process.

D. Manhole Lighting, where required: Provide NEMA 3R lighting switch mounted no more than 600 mm (2 feet) from top of ladder and a 27 W compact fluorescent wet location light fixture in manhole. Provide dedicated 20 mm (0.75 inch) direct-buried conduit and conductors to nearest electrical panelboard.

E. Sump Pump, where required: Provide 120V cord and plug connected sump pump complete with float switch, thermal overload protection, and GFCI receptacle with in-use HD cover, mounted in NEMA 3R boxes in manhole. Provide dedicated 20 mm (0.75 inch) direct-buried conduit and conductors to nearest electrical panelboard.

3.2 TRENCHING

A. Refer to Utility Provider requirements for trenching, backfilling, and compaction.

B. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.

C. Cut the trenches neatly and uniformly.

D. For Concrete-Encased Ducts:

1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 1.2 M (4 foot) intervals to establish the grade and route of the duct bank.
2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

E. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the Engineer.

3.3 DUCT INSTALLATION

A. General Requirements:

1. Ducts shall be in accordance with the NEC, as shown on the drawings, and as specified.

2. Join and terminate ducts with fittings recommended by the manufacturer.
3. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inch) in 30 M (100 feet).
4. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) outside the building foundation. Tops of conduits below building slab shall be minimum 610 mm (24 inches) below bottom of slab.
5. Stub-ups and sweeps to equipment mounted on outdoor concrete slabs shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) away from the edge of slab.
6. Install insulated grounding bushings on the conduit terminations.
7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 1.5 M (5 feet). Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, chilled water.
10. Clearances between individual ducts:
    a. For similar services, not less than 75 mm (3 inches).
    b. For power and signal services, not less than 150 mm (6 inches).
11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.

15. Duct Identification: Place continuous strip of warning tape approximately 300 mm (12 inches) above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Concrete-Encased Ducts:
   1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
   2. Duct banks shall be single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
   3. Tops of concrete-encased ducts shall be:
      a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
      b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
      c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
      d. Conduits crossing under grade slab construction joints shall be installed a minimum of 1.2 M (4 feet) below slab.
   4. Extend the concrete envelope encasing the ducts not less than 75 mm (3 inches) beyond the outside walls of the outer ducts.
   5. Within 3 M (10 feet} of building and manhole wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
   6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
   7. Where new ducts and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.

8. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75 inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by Engineer.

C. Direct-Burial Ducts:
   1. Install direct-burial ducts only where shown on the drawings. Provide direct-burial ducts only for low-voltage power and lighting branch circuits.
   2. Tops of ducts shall be:
      a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
      b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
      c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
   3. Do not kink the ducts. Compaction shall not deform the ducts.

D. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 300 mm (12 inches) in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

E. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

F. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

G. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the Engineer at no cost to the Engineer.
4. Mandrel pulls shall be witnessed by the Engineer.

---END OF SECTION---

SECTION 26 09 23 - LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the lighting controls.

1.2 RELATED WORK

A. Any interface of lighting controls with HVAC control systems.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

E. Section 26 24 16, PANELBOARDS: Panelboard enclosure and interior bussing used for lighting control panels.

F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

G. Section 26 51 00, INTERIOR LIGHTING: Luminaire ballast and drivers used in control of lighting systems.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
    a. Submit the following information for each type of lighting controls.
    b. Material and construction details.
    c. Physical dimensions and description.

d. Wiring schematic and connection diagram.
e. Installation details.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the Contractor that the lighting control systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Green Seal (GS):

GC-12-03 ..... Occupancy Sensors

C. National Electrical Manufacturer's Association (NEMA):

C136.10-10 ..... American National Standard for Roadway and Area Lighting Equipment—Locking-Type Photocontrol Devices and Mating Receptacles—Physical and Electrical Interchangeability and Testing

ICS-1-08..... Standard for Industrial Control and Systems General Requirements

ICS-2-05..... Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment

ICS-6-11..... Standard for Industrial Controls and Systems Enclosures

D. National Fire Protection Association (NFPA):

70-14..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

20	Standard for General-Use Snap Switches
773-95	Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting
773A-06	Nonindustrial Photoelectric Switches for Lighting Control
98-04	Enclosed and Dead-Front Switches
916-07	Standard for Energy Management Equipment Systems
917-06	Clock Operated Switches
924-06	Emergency Lighting and Power Equipment (for use when controlling emergency circuits).

F. California Energy Commission:

Latest	Title 24 controls for lighting and power management. Controls required under T-24 shall be CEC approved.

PART 2 - PRODUCTS

2.1 ELECTRONIC TIME SWITCHES

A. Electronic, solid-state programmable units with alphanumeric display; complying with UL 916 and or 917.
   1. Contact Configuration: SPST, DPST, DPDT as required and/or as shown in drawings.
   2. Contact Rating: 30-A inductive or resistive120-277 volt, 20-A ballast load, 120-277 volt as shown in drawings.
   3. Astronomical Clock: Capable of switching a load on at sunset and off at sunrise, and automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Additionally, it shall be programmable to a fixed on/off weekly schedule.
   4. Power Backup: Battery or capacitor for schedules and time clock.

2.2 ELECTROMECHANICAL-DIAL TIME SWITCHES

A. Electromechanical-dial time switches; complying with UL 917.
   1. Contact Configuration: SPST, DPST, DPDT, as shown in drawings.
   2. Contact Rating: 30-A inductive or resistive, 120-277 volt, 20-A ballast load, 120-277 volt as shown in drawings.

3. Wound-spring reserve carryover mechanism to keep time during power failures.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

A. Solid state, with SPST or DPST dry contacts rated for 1800 VA tungsten or 1000 VA inductive, complying with UL 773A as shown in drawings.
   1. Light-Level Monitoring Range: 16.14 to 108 lx (1.5 to 10 fc), with adjustable turn-on and turn-off levels.
   2. Time Delay: 15-second minimum.
   3. Surge Protection: Metal-oxide varistor (MOV).
   4. Mounting: Twist lock, with base-and-stem mounting or stem-and-swivel mounting accessories as required.

2.4 TIMER SWITCHES

A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.
   1. Compatibility: Compatible with all ballasts.
   2. Warning: Audible warning to sound during the last minute of “on” operation.
   3. Time-out: Adjustable from 5 minutes to 12 hours.
   4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

2.5 CEILING-MOUNTED PHOTOELECTRIC SWITCHES

A. Solid-state, light-level sensor unit, with separate relay unit.
   1. Sensor Output: Contacts rated to operate the associated relay. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
   3. Monitoring Range: 108 to 2152 lx (10 to 200 fc), 1080 to 10 800 lx (100 to 1000 fc), with an adjustment for turn-on and turn-off levels, as required in drawings.
   4. Time Delay: Adjustable from 5 to 300 seconds, with deadband adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.6 SKYLIGHT PHOTOELECTRIC SENSORS

A. Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight; with separate relay unit.
   1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   2. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
   3. Monitoring Range: 10,800 to 108,000 lx (1000 to 10,000 fc), with an adjustment for turn-on and turn-off levels.
   4. Time Delay: Adjustable from 5 to 300 seconds, with deadband adjustment.
   5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.7 INDOOR OCCUPANCY SENSORS

A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
   2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Manual/automatic selector switch.
   8. Automatic Light-Level Sensor: Adjustable from 21.5 to 2152 lx (2 to 200 fc); keep lighting off when selected lighting level is present.

9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 150 mm (6-inch) minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm (36 sq. in), and detect a person of average size and weight moving not less than 305 mm (12 inches) in either a horizontal or a vertical manner at an approximate speed of 305 mm/s (12 inches/s).

C. Detection Coverage: Shall be sufficient to provide coverage as required by sensor locations shown on drawing.

2.8 INDOOR VACANCY SENSOR SWITCH

A. Wall mounting, solid-state units with integral sensor and switch.
   1. Operation: Manually turn lights on with switch and sensor detects vacancy to turn lights off.
   2. Switch Rating: 120/277 volt, 1200 watts at 277 volt, 800 watts at 120 volt unit.
   3. Mounting:
      a. Sensor: Suitable for mounting in a standard switch box.
      b. Time-Delay and Sensitivity Adjustments: Integral with switch and accessible for reprogramming without removing switch.
   4. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   5. Switch: Manual operation to turn lights on and override lights off.
   6. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

2.9 OUTDOOR MOTION SENSOR (PIR)

A. Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 degrees F (minus 40 to plus 54 degrees C).

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a 1 to 15 minute adjustable time delay for turning lights off.
2. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
   b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
3. Bypass Switch: Override the on function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 11 to 215 lx (1 to 20 fc); keep lighting off during daylight hours.

B. Detector Sensitivity: Detect occurrences of 150 mm (6-inch) minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm (36 sq. in).

C. Detection Coverage: Shall be sufficient to provide coverage as required by sensor locations shown on drawing.

D. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   1. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
   2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

LIGHTING CONTROL SYSTEMS: SECTIONS 2.10-2.14, AS APPLICABLE - PER TITLE 24

2.10 LIGHTING CONTROL SYSTEM – RELAY PANEL TYPE (NETWORK)

A. System Description:
   1. The lighting control system shall be a network of lighting relay panels connected to a digital network and controlled through a system server / central station. Lighting control devices connect to the relay panels and communicate via the panel controller with the system server. System includes all associated network interfaces and wiring, relay panels, control modules, input modules, panel processors, relays, photocells, switches, dimmers, time clock, and occupancy sensors.

2. System shall include server / central station with operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system specified elsewhere.
3. System server / central station shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

B. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between system devices, network and control system server/ central station such that system performs as described. Server / central control station shall have a minimum 500 GB hard drive, 8GB RAM, 3 GHz speed minimum, three Ethernet ports, 1024 x 768 resolution graphic card, and 3 USB 3.0 ports. Server shall be provided with monitor, keyboard and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.

C. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.

D. Directory: Identifies each relay as to load controlled.

E. System Power Supply: Transformer and full-wave rectifier with filtered dc output for panel, controllers and control devices. Feed from an equipment emergency circuit at a minimum.

F. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20A, 125 volt AC for tungsten filaments and 20A, 277 volt AC for electronic ballasts, 50,000 cycles at rated capacity.

G. Control Devices: All occupancy sensors (Ultrasonic, IR and Dual Technology type), photocells, switches and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

2.11 LIGHTING CONTROL SYSTEM – RELAY PANEL TYPE (STAND ALONE)

A. System Description:

1. The lighting control system shall be with lighting relay panels. Lighting control devices connect to the relay panels and communicate via the panel controller. System includes all interfaces and wiring, relay panels, control modules, input modules, panel processors, relays, photocells, switches, dimmers, time clock, and occupancy sensors.
2. System shall include the capability of BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system specified elsewhere.
3. Panel Controller shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

B. Panel Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from control devices and other sources. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.

C. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.

D. Directory: Identifies each relay as to load controlled.

E. System Power Supply: Transformer and full-wave rectifier with filtered dc output for panel, controllers and control devices. Feed from an equipment emergency circuit at a minimum.

F. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20A, 125 volt AC for tungsten filaments and 20A, 277 volt AC for electronic ballasts, 50,000 cycles at rated capacity.

G. Control Devices: All occupancy sensors (Ultrasonic, IR and Dual Technology type), photocells, switches and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

2.12 LIGHTING CONTROL SYSTEM – DISTIBUTIVE RELAY TYPE

A. System Description:
   1. The lighting control system shall be a network of remote relay modules connected to a digital network via network hubs and controlled through a system server / central station. Lighting control devices connect to the relay modules and communicate via the digital network with the system server. System includes all associated network interfaces and wiring, hubs, relay modules, relays, photocells, switches, dimmers, time clock, and occupancy sensors. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.
   2. System shall include server / central station with operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system specified elsewhere.
   3. System server / central station shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

B. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between relay modules, network hubs and control system server/ central station such that system performs as described. Server / central control station shall have a minimum 500 GB hard drive, 8GB RAM, 3 GHz speed minimum, three Ethernet ports, 1024 x 768 resolution graphic card, and 3 USB 3.0 ports. Server shall be provided with monitor, keyboard and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.

C. Network Hub: Network Hub shall contain processor and astronomic time clock for control and monitoring of lighting. Network Hub shall be fed from an equipment emergency circuit at a minimum.

D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277 volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment

shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to 4 relays. Relay modules shall be labeled with room number that relays control lighting within.

E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20A, 125 volt AC for tungsten filaments and 20A, 277 volt AC for electronic ballasts, 50,000 cycles at rated capacity.

F. Control Devices: All occupancy sensors (Ultrasonic, IR and Dual Technology type), photocells, switches and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

2.13 LIGHTING CONTROL SYSTEML – CIRCUIT BREAKER PANEL TYPE

A. Controller: Panelboard mounted in compliance with UL 916, programmable, solid-state, astronomic 365-day timing and control unit with non-volatile memory. Controller shall be integral to panelboard as specified in Section 26 24 16, PANELBOARDS. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Controller communication protocol shall be compatible with the building automation system specified elsewhere. Panelboard shall use low-voltage-controlled, electrically operated molded-case branch circuit breakers or molded-case branch circuit breakers with switching accessories. Circuit breakers and a limited number of digital or analog, low-voltage control-circuit outputs shall be individually controlled by control module. Panelboard shall also comply with Section 24 26 16, PANELBOARDS.

B. Electrically Operated, Molded-Case Circuit-Breaker Panelboard: Per Section 26 24 16, PANELBOARDS.

C. Electrically Operated, Molded-Case Circuit Breakers: Per Section 26 24 16, PANELBOARDS.

D. Switching Endurance Ratings: Rated at least 20,000 open and close operations under rated load at 0.8 power factor.

2.14 LIGHTING CONTROL SYSTEM – DIGITAL ADDRESSABLE LIGHTING INTERFACE (DALI)

A. System Description:

1. The lighting control system shall consist of digital lighting control network connecting DALI compliant digital addressable ballasts, control modules and lighting control devices directly with a system server / central control station. Individually addressable electronic ballasts, control modules, and control devices are operated from signals received through DALI-compliant bus from variety of DALI compliant digital controllers and interfaces and programmed through the system server / central control station. System includes all associated network bus and wiring, DALI controllers and interfaces, panels, photocells, switches, dimmers, time clock, and occupancy sensors. System shall utilize DALI compliant ballast and dimming modules provided with light fixtures.
2. System shall include server / central station with DALI operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system specified elsewhere.
3. System server / central station shall provide programmable operation of lights connected via system bus and controlled with system devices. System software shall provide control of DALI ballast, control modules and control devices, time and sequence scheduling, timed out and blink light operation and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

B. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between relay modules, network hubs and control system server/ central station such that system performs as described. Server / central control station shall have a minimum 500 GB hard drive, 8GB RAM, 3 GHz speed minimum, three Ethernet ports, 1024 x 768 resolution graphic card, and 3 USB 3.0 ports. Server shall be provided with monitor, keyboard and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.

C. Control Devices: All occupancy sensors (Ultrasonic, IR and Dual Technology type), photocells, switches and timers shall be provided with system and be DALI compliant. Devices shall be designed to operate on system network. Supplemental DALI compliant signal repeaters and controllers shall be provided as required. This equipment shall be identified in shop drawing submission.

PART 3 - EXECUTION

3.1 INSTALLATION : LIGHTING & POWER CONTROLS SHALL BE CEC APPROVED

A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.

B. Aim outdoor photoelectric sensor according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle turn-on.

C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer’s recommendations.

D. Set occupancy sensor "on" duration per Owner (5-15 minutes).

E. Locate photoelectric sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the available light level at the typical work plane for that area.

F. Label time switches and contactors with a unique designation.

G. Program lighting control panels per schedule on drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.

B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range (no flicker is allowed).

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

E. Upon completion of the installation, the system shall be commissioned by the manufacturer’s factory-authorized technician who will verify all adjustments and sensor placements. It shall also be tested as required by CEC, by CEC certified technician.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function in the presence of Engineer.

3.4 INSTRUCTION

A. Furnish the services of a factory-trained technician for one 4-hour training period for instructing personnel in the maintenance and operation of the lighting control system on the dates requested by the Owner.

B. Contractor shall submit written instructions on training and maintenance as reviewed in training session.

- - - END of SECTION - - -

SECTION 26 23 00 - LOW-VOLTAGE SWITCHGEAR

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of low-voltage switchgear, indicated as switchgear in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

E. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.

F. Section 26 43 13, SURGE PROTECTIVE DEVICES: For surge protective devices integral to the switchgear.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

A. Switchgear shall be thoroughly tested at the factory, with the circuit breakers in the connected position in their compartments. Tests shall be in accordance with IEEE C37.20.1 and NEMA C37.51. Factory tests shall be certified, and shall include the following tests:

1. Design tests.
2. Production tests.
3. Conformance tests.

B. The following additional tests shall be performed:
   1. Verify that circuit breaker sizes and types correspond to drawings, and the Overcurrent Protective Device Coordination Study.
   2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
   3. Confirm correct operation and sequencing of any key-type mechanical interlock systems for multiple circuit breakers by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
   4. Verify correct barrier and shutter installation and operation.
   5. Exercise all active components.
   6. Inspect indicating devices for correct operation.
   7. Perform an insulation-resistance test, phase to ground, on each bus section, with phases not under test grounded, in accordance with manufacturer's published data.
   8. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 V DC for 300-volt rated cable and 1000 V DC for 600-volt rated cable, or as required if solid-state components or control devices cannot tolerate the applied voltage.
   9. If applicable, verify correct function of control transfer relays located in the switchgear with multiple control power sources.
   10. Perform phasing checks on double-ended or dual-source switchgear to insure correct bus phasing from each source.

C. Furnish four (4) copies of certified manufacturer's factory test reports prior to shipment of the switchgear to ensure that the switchgear has been successfully tested as specified.

D. The Owner shall have an option to witness the factory tests. All expenses of the Owner Representative's trips to witness the testing will be paid by the Owner. Notify the Engineer not less than 30 days prior to making tests at the factory.

1.5 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
   1. Shop Drawings:

a. Switchgear shop drawings shall be submitted simultaneously with or after the Overcurrent Protective Device Coordination Study.
b. Submit sufficient information to demonstrate compliance with drawings and specifications.
c. Prior to fabrication of switchgear, submit the following data for approval:
    1) Complete electrical ratings.
    2) Circuit breaker sizes.
    3) Interrupting ratings.
    4) Safety features.
    5) Accessories and nameplate data.
    6) Switchgear one line diagram, showing ampere rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.
    7) Elementary and interconnection wiring diagrams.
    8) Technical data for each component.
    9) Dimensioned exterior views of the switchgear.
    10) Dimensioned section views of the switchgear.
    11) Floor plan of the switchgear.
    12) Foundation plan for the switchgear.
    13) Provisions and required locations for external conduit and wiring entrances.
    14) Approximate design weights.
d. Certification from the manufacturer that representative switchgear has been seismically tested to California Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by anecdotal data or other informal methods.

2. Manuals:
    a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
        1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the switchgear.

2) Include information for testing, repair, trouble shooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that switchgear conforms to the requirements of the drawings and specifications.
   b. Certification by the Contractor that switchgear has been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata), form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

C37.13-08 ..... Low-voltage AC Power Circuit Breakers Used in Enclosures

C37.20.1-07 ..... Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

C57.13-08 ..... Instrument Transformers

C62.41.1-03 ..... Surge Environment in Low-voltage (1000V and less) AC Power Circuits

C62.45-92 ..... Surge Testing for Equipment connected to Low-Voltage AC Power Circuits

C. International Code Council (ICC):

IBC-12..... International Building Code (California Building Code)

D. National Electrical Manufacturers Association (NEMA):

C37.51-10 ..... Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies — Conformance Test Procedures

E. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)(California Electrical Code).

F. Underwriters Laboratories, Inc. (UL):

891-05 ..... Switchboards

977-07 ..... Safety Fused Power-Circuit Devices

1053-99 ..... Ground Fault Sensing and Relaying Equipment

1558-99 ..... Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

PART 2 - PRODUCTS

2.1 GENERAL

A. Shall be in accordance with ANSI, IEEE, NEMA, NFPA, UL, as shown on the drawings, and have the following features:

1. Switchgear shall be a complete, grounded, continuous-duty, integral assembly, metal clad (for MV), dead-front, dead-rear, self-supporting, indoor type switchgear assembly, or tamperproof, weatherproof, outdoor type switchgear assembly with metal housing and a walk-in protected front space. Incorporate devices shown on the drawings and all related components required to fulfill operational and functional requirements.
2. Switchgear shall be Type 1 front accessible or Type 2, front, side, and rear accessible.
3. Ratings shall not be less than shown on the drawings. Short circuit ratings shall not be less than 65kA.
4. Switchgear shall conform to the arrangements and details shown on the drawings.
5. Coordinate all requirements with the electric utility company supplying electrical service to the switchgear. The incoming electric utility feeder and revenue metering installation shall conform to the requirements of the electric utility company.//
6. Key-type mechanical interlocks for multiple circuit breakers shall be provided as shown on the drawings.//
7. Switchgear shall be assembled, connected, and wired at the factory so that only external circuit connections are required at the construction site. Split the structure only as required for shipping and installation. Packaging shall provide adequate protection against rough handling during shipment.

8. All non-current-carrying parts shall be grounded per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS for additional requirements.
9. Provide power metering from main breaker or by other means meeting Title 24 power monitoring and management requirements.

2.2 HOUSING

A. Shall have the following features:
   1. Frames and enclosures:
      a. The assembly shall be braced with reinforcing gussets using bolted connections or jig welds// to assure rectangular rigidity and seismic adequacy.
      b. The enclosure shall be steel, leveled, and not less than the gauge required by applicable publications.
      c. Die-pierce the holes for connecting adjacent structures to insure proper alignment, and to allow for future additions.
      d. All bolts, nuts, and washers shall be zinc-plated or cadmium-plated steel.
   2. Circuit breaker compartments:
      a. An individual compartment shall be supplied for each circuit breaker and each future circuit breaker as shown on the drawings. Compartments shall be provided with isolated wireways for control wiring between devices.
         1) Separate each compartment so that the circuit breaker, buses, and cable terminations are in separate compartments with steel partitions or barriers of approved and properly installed insulation.
         2) Each compartment furnished with a circuit breaker (active or spare) shall be fully equipped as noted on drawings and specified below.
         3) Each compartment noted as space for future circuit breaker, as shown on drawings, shall be fully equipped for positioning and connecting the breaker. Provide all equipment required to implement the future breaker installation.
   3. Auxiliary compartments:
      a. Compartments shall be provided for auxiliaries, metering, and transition or termination sections as required by the manufacturer, and as shown on drawings. Compartments shall be provided with isolated wireways for control wiring between devices.
   4. Compartment doors:

a. The doors shall permit convenient removal and interchanging of circuit breakers between compartments. The doors shall be capable of a swing approaching 180 degrees.
b. Concealed or semi-concealed hinges shall be provided to attach the doors. Weld the hinges to the equipment structure and to the compartment doors.

2.3 BUSES

A. Bus Bars and Interconnections:
   1. Provide copper phase and neutral buses, fully rated for the amperage as shown on the drawings for the entire length of the switchgear. Bus laminations shall have a minimum of 6 mm (1/4 inch) spacing.
   2. Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.
   3. The bus and bus compartment shall be designed so that the acceptable NEMA standard temperature rises are not exceeded.
   4. Install a copper ground bus the full length of the switchgear assembly.
   5. Main Bonding Jumper: An un-insulated copper bus, size as shown on drawings, shall interconnect the neutral and ground buses, when the switchgear is used to establish the system common ground point.
   6. All bolts, nuts, and washers shall be zinc-plated or cadmium-plated steel. Bolts shall be torqued with a calibrated torque wrench to the values recommended by the manufacturer.
   7. Make provisions for future bus extensions by means of bolt holes or other approved method.

2.4 LOW-VOLTAGE POWER CIRCUIT BREAKERS

A. General: Circuit breakers shall be dead front; larger than 1600A shall be drawout, stored energy type with solid state trip devices. Arcing contacts shall be renewable.
B. Rating: Circuit breakers shall be 3 pole, 600 volts AC and below, 60 cycle with frame size, trip rating and functions, and system voltage as shown on drawings. Breakers shall have 30 cycle short time current ratings.
C. Drawout Mounting: Where drawout is required, provide a racking mechanism to position and hold the breaker in the connected, test, or disconnected position. Provide an

interlock to prevent movement of the breaker into or out of the connected position unless the breaker is tripped open.

D. Trip Devices: Breakers shall be electrically and mechanically trip free and shall have trip devices in each pole. Unless otherwise indicated on drawings, each breaker shall have overcurrent and short-circuit , and where shown in drawings, integral ground fault trip devices. Where trip devices are required to be solid state type to achieve coordination or to limit arc-flash energy, they shall have adjustable pick-up settings, with both long time and short time elements, and integral trip unit testing provisions. Devices shall have time-delay band adjustment. Long-time delay element shall have inverse time characteristics. Main circuit breakers shall not have instantaneous trip function if its omission is required to achieve coordination. Branch circuit breakers may be mechanical only IF they can be coordinated with upstream breakers.
E. Position Indicator: Provide a mechanical indicator visible from the front of the unit to indicate whether the breaker is open or closed.
F. Trip Button: Equip each breaker with a mechanical trip button accessible from the front of the door.
G. Padlocking: Provisions shall be included for padlocking the breaker in the open position.
H. Operation: Unless otherwise indicated herein or on the drawings, breakers 1600 ampere frame size and less shall be manually operated. Breakers larger than 1600 ampere frame size shall be electrically operated.

2.5 ELECTRIC UTILITY COMPANY EQUIPMENT

A. Provide separate compartment for electric utility company metering equipment as shown on drawings.
B. Provide suitable arrangements within the electric utility company metering compartment for mounting metering equipment. Obtain the electric utility company's approval of the compartment arrangements prior to fabrication of the switchgear.
C. Allow access to electric utility company personnel as required for installation of utility metering equipment.//

2.6 BATTERY SYSTEM (PROTECTIVE RELAY & SWITCH POWER) – IF IN DRAWINGS

A. Batteries:

1. Provide high discharge rate type maintenance-free nickel-cadmium batteries. Battery voltage shall be 125 or 48 volts nominal. Calculate the battery capacity based on the lowest ambient temperature in the room where it is to be installed. Include a safety margin of 50 percent for reserve capacity.
    a. Provide sufficient battery capacity to carry all continuous loads (lamps, relays, etc.) for 8 hours and then perform the greater of the following duties, with the charger de-energized.
        1) Trip all circuit breakers simultaneously or,
        2) Close the largest breaker in a line-up of four or less breakers, or close the two largest breakers simultaneously in a line-up of more than four breakers. Breaker closing current shall include both the spring release coil current and the starting current of the spring charging motor.
2. Provide battery connector covers for protection against external short circuits.
3. Provide corrosion-resistant steel battery racks.
4. In seismic areas, batteries shall be secured to the battery rack to prevent overturning during a seismic event. Battery rack shall also be secured to the floor.

B. Battery Charger:
1. Provide a charger of the full wave rectifier type utilizing silicon controlled rectifiers as the power-control elements. Construction shall be modular with plug-in control units for easy replacement.
2. The charger shall maintain 1/2 of one percent voltage regulation from no load to full load for line voltage variation of 10 percent, and frequency variation of 3 Hz from 60 Hz.
3. The charger shall maintain a nominal float voltage of 1.4 vpc, and a nominal equalizing voltage of 1.5 vpc.
4. The charger shall be capable of continuous operation in an ambient temperature of 40 °C (104 °F) without derating. The charger shall be installed in a convection cooled NEMA Type 1 ventilated enclosure. The housing is to have a hinged front door with all equipment accessible from the front.
5. Provide both AC and DC transient protection. Charger shall be able to recharge a fully discharged battery without tripping AC protective devices. AC circuit breaker shall not trip under any DC load condition, including short circuit on output terminals.
6. The charger shall be capable of supplying the following demand simultaneously:

a. Recharging a fully discharged battery in 12 hours.
b. Supervisory panel and control panel.
c. Steady loads (indicating lamps, relays, etc.).

7. The charger shall have fused AC input and DC output protection.
8. The charger shall not discharge the batteries when AC power fails.
9. The charger shall have the following accessories:
   a. On-off control switch with pilot light.
   b. AC power failure alarm light.
   c. High DC voltage alarm light.
   d. Low DC voltage alarm light.
   e. Ground detection switch and alarm light.
   f. DC ammeter - 2 percent accuracy.
   g. DC voltmeter - 2 percent accuracy: Float/equalize voltage marked in red on voltmeter.
   h. Provisions for activation of remote annunciation of trouble for the above conditions.

2.7 SURGE PROTECTIVE DEVICE

A. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

2.8 SECONDARY METERING (OTHER THAN UTILITY METERING)

A. Refer to Section 25 10 10 if provided, ADVANCED UTILITY METERING. Refer to drawings for meter locations.
B. As necessary, provide compartment with a front hinged door to provide safe isolated access to meters and all associated terminal and fuse blocks for maintenance, calibration, or testing.
C. Provide current transformers for each meter if required. Current transformers shall be wired to shorting-type terminal blocks.
D. Provide voltage transformers including primary fuses and secondary protective devices for metering if required on the drawings.

2.9 OTHER EQUIPMENT

A. Furnish tools and accessories required for circuit breaker and switchgear test, inspection, maintenance, and proper operation.

B. Panelboards: Requirements for panelboards shown to be installed in the switchgear shall be as shown on the drawings and in Section 26 24 16, PANELBOARDS.

2.10 CONTROL WIRING

A. Switchgear control wires shall not be less than No. 14 AWG copper 600 V rated. Install wiring complete at the factory, adequately bundled and protected. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

2.11 NAMEPLATES AND MIMIC BUS

A. Nameplates: For Normal Power system, provide laminated black phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. For Essential Electrical System, provide laminated red phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings. Nameplates shall be mounted with plated screws on front of breakers or on equipment enclosure next to breakers. Mounting nameplates only with adhesive is not acceptable.

B. Mimic Bus: If required in drawings. provide an approved mimic bus on front of each switchgear assembly. Color shall be black for the Normal Power system and red for the Essential Electrical System, either factory-painted plastic or metal strips. Plastic tape shall not be used. Use symbols similar to one line diagram shown on drawings. Plastic or metal strips shall be mounted with plated screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchgear in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Anchor switchgear with rustproof bolts, nuts, and washers not less than 13 mm (1/2 inch) diameter, in accordance with manufacturer's instructions, and as shown on drawings.

C. In seismic areas, switchgear shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Exterior Location. Mount switchgear on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 15 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit risers and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified on the Structural Drawings.

E. Interior Location. Mount switchgear on concrete slab. Unless otherwise indicated, the slab shall be at least 100 mm (4 inches) thick. The top of the concrete slab shall be approximately 100 mm (4 inches) above finished floor. Edges above floor shall have 15 mm (1/2 inch) chamfer. The slab shall be sized to project no more that five inches beyond the equipment. Provide conduit risers and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified on the Structural Drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
    a. Compare equipment nameplate data with specifications and approved shop drawings.
    b. Inspect physical, electrical, and mechanical condition.

c. Confirm correct application of manufacturer's recommended lubricants.
d. Verify appropriate anchorage, required area clearances, and correct alignment.
e. Verify that circuit breaker sizes and types correspond to approved shop drawings.
f. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
//g. Confirm correct operation and sequencing of key-type mechanical interlock systems.//
h. Vacuum-clean switchgear enclosure interior. Clean switchgear enclosure exterior.
i. Inspect insulators for evidence of physical damage or contaminated surfaces.
j. Verify correct shutter installation and operation.
k. Exercise all active components.
l. Verify the correct operation of all sensing devices, alarms, and indicating devices.
m. Verify that vents are clear.

2. Electrical tests:
a. Perform insulation-resistance tests on each bus section.
b. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
c. Perform phasing check on double-ended switchgear to ensure correct bus phasing from each source.

//B. Prior to the final inspection for acceptance, a technical representative from the electric utility company shall witness the testing of the equipment to assure the proper operation of the individual components, and to confirm proper operation/coordination with electric utility company's equipment.//

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the switchgear is in good operating condition and properly performing the intended function.

3.4 TEMPORARY HEATING

A. Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.5 WARNING SIGN

A. Mount on each entrance door of the //outdoor switchgear enclosure//switchgear room//, approximately 1500 mm (5 feet) above grade or floor**,** a clearly lettered warning sign for warning personnel. The sign shall be attached with rustproof metal screws.

3.6 ONE LINE DIAGRAM AND SEQUENCE OF OPERATION

A. At final inspection, an as-built one line diagram shall be laminated or mounted under acrylic glass, and installed in a frame mounted in the switchgear room or in the outdoor switchgear enclosure.

B. Furnish a written sequence of operation for the switchgear and connected line side/load side electrical distribution equipment. The sequence of operation shall be laminated or mounted under acrylic glass, and installed in a frame mounted in the switchgear room or in the outdoor switchgear enclosure.

C. Deliver an additional four copies of the as-built one line diagram and sequence of operation to the //Resident Engineer// //COTR//.

3.7 AS-LEFT TRIP UNIT SETTINGS

A. The trip unit settings shall be set in the field by an authorized representative of the switchgear manufacturer, Overcurrent Protective Devices shall be coordinated.

B. The trip unit settings of the main breaker(s) shall be reviewed by the electric utility company to assure coordination with the electric utility company primary fusing. Prior to switchgear activation, provide written verification of this review to the //Resident Engineer// //COTR//.

C. Post a durable copy of the "as-left" trip unit settings in a convenient location in the //switchgear room //outdoor switchgear enclosure//. Deliver four additional copies of the settings to the //Resident Engineer// //COTR//. Furnish this information prior to the activation of the switchgear.

3.8 INSTRUCTION

A. Furnish the services of a factory-trained technician for two, 4-hour training periods for instructing personnel in the maintenance and operation of the switchgear, on the dates requested by the //Resident Engineer// //COTR//.

---END---

SECTION 26 24 13 - DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the low-voltage circuit-breaker distribution switchboards, indicated as switchboard(s) in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible fault currents.
D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit.
E. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective devices for switchboards.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

A. Switchboards shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects. Tests shall be conducted as per NEMA PB 2. Factory tests shall be certified.
B. The following additional tests shall be performed:
    1. Verify that circuit breaker sizes and types correspond to drawings, and the Overcurrent Protective Device Coordination Study.
    2. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.

3. Confirm correct operation and sequencing of key-type mechanical interlock systems for multiple circuit breakers by attempting closure on locked-open devices, and attempting to open locked-closed devices, and making key exchange with devices operated in off-normal positions.
4. Exercise all active components.
5. Perform an insulation-resistance test, phase to ground, on each bus section, with phases not under test grounded, in accordance with manufacturer's published data.
6. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 V DC for 300-volt rated cable and 1000 V DC for 600-volt rated cable, or as required if solid-state components or control devices cannot tolerate the applied voltage.
7. If applicable, verify correct function of control transfer relays located in the switchboard with multiple control power sources.
8. Perform phasing checks on double-ended or dual-source switchboards to insure correct bus phasing from each source.

C. Furnish four (4) copies of certified manufacturer's factory test reports prior to shipment of the switchboards to ensure that the switchboards have been successfully tested as specified.

D. The Owner shall have an option to witness the factory tests. All expenses of the Owner Representative's trips to witness the testing will be paid by the Owner. Notify the Engineer not less than 30 days prior to making tests at the factory.

1.5 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. Switchboard shop drawings shall be submitted simultaneously with or after the Overcurrent Protective Device Coordination Study.
   b. Submit sufficient information to demonstrate compliance with drawings and specifications.
   c. Prior to fabrication of switchboards, submit the following data for approval:
      1) Complete electrical ratings.
      2) Circuit breaker sizes.

3) Interrupting ratings.
4) Safety features.
5) Accessories and nameplate data.
6) Switchboard one line diagram, showing ampere rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.
7) Elementary and interconnection wiring diagrams.
8) Technical data for each component.
9) Dimensioned exterior views of the switchboard.
10) Dimensioned section views of the switchboard.
11) Floor plan of the switchboard.
12) Foundation plan for the switchboard.
13) Provisions and required locations for external conduit and wiring entrances.
14) Approximate design weights.

d. Certification from the manufacturer that representative switchboards have been seismically tested to California Building Code and IBC requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not on anecdotal data or other informal methods.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the switchboard.
      2) Include information for testing, repair, trouble shooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
      3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the manufacturer that the switchboards conform to the requirements of the drawings and specifications.
b. Certification by the Contractor that the switchboards have been properly installed, adjusted, and tested per manufacturer's and contract requirements.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

C37.13-08 ..... Low Voltage AC Power Circuit Breakers Used in Enclosures

C57.13-08 ..... Instrument Transformers

C62.41.1-03 ..... Surge Environment in Low-voltage (1000V and less) AC Power Circuits

C62.45-92 ..... Surge Testing for Equipment connected to Low-Voltage AC Power Circuits

C. International Code Council (ICC):

IBC-12 ..... International Building Code

D. National Electrical Manufacturer's Association (NEMA):

PB-2-06 ..... Deadfront Distribution Switchboards

PB-2.1-07 ..... Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less

E. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)

F. Underwriters Laboratories, Inc. (UL):

67-09 ..... Panelboards

489-09 ..... Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

891-05 ..... Switchboards

PART 2 - PRODUCTS

2.1 GENERAL

A. Shall be in accordance with ANSI, IEEE, NEMA, NFPA, UL, as shown on the drawings, and have the following features:

1. Switchboard shall be a complete, grounded, continuous-duty, integral assembly, dead-front, dead-rear, self-supporting, indoor type switchboard assembly, or tamperproof, weatherproof, outdoor type switchboard assembly, per drawings. Incorporate devices shown on the drawings and all related components required to fulfill operational and functional requirements.
2. Ratings shall not be less than shown on the drawings. Short circuit ratings shall not be less than the available fault current shown in the Overcurrent Protective Device Coordination Study.
3. Switchboard shall conform to the arrangements and details shown on the drawings.
4. Coordinate all requirements with the electric utility company supplying electrical service to the switchboard. The incoming electric utility feeder and revenue metering installation shall conform to the requirements of the electric utility company.
5. Key-type mechanical interlocks for multiple circuit breakers shall be provided if shown on the drawings.
6. Switchboards shall be assembled, connected, and wired at the factory so that only external circuit connections are required at the construction site. Split the structure only as required for shipping and installation. Packaging shall provide adequate protection against rough handling during shipment.
7. All non-current-carrying parts shall be grounded per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS for additional requirements.
8. Series rated switchboards are not allowed.

2.2 BASIC ARRANGEMENT

A. Type 1: Switchboard, if specified, shall be front accessible with the following features:

1. Device mounting:
   a. Main breaker: Individually mounted and compartmented or group mounted with feeder breakers.
   b. Feeder breakers: Group mounted.
2. Section alignment: As shown on the drawings.

3. Accessibility:
    a. Main section line and load terminals: Front and side.
    b. Distribution section line and load terminals: Front.
    c. Through bus connections: Front and end.
4. Bolted line and load connections.
5. Full height wiring gutter covers for access to wiring terminals.

B. Type 2: Switchboard, if specified, shall be rear accessible with the following features:
1. Device mounting:
    a. Main breaker: Individually mounted and compartmented.
    b. Feeder breakers: Individually mounted and compartmented.
2. Section alignment: As shown on drawings.
3. Accessibility:
    a. Main section line and load terminals: Rear.
    b. Distribution section line and load terminals: Rear.
    c. Bus connections: Rear.
4. Bolted line and load connections.
5. Full height wiring gutter covers for access to wiring terminals.

2.3 HOUSING

A. Shall have the following features:
1. Frames and enclosures:
    a. The assembly shall be braced with reinforcing gussets using bolted connections or jig welds to assure rectangular rigidity and seismic adequacy.
    b. The enclosure shall be steel, leveled, and not less than the gauge required by applicable publications.
    c. Die-pierce the holes for connecting adjacent structures to insure proper alignment, and to allow for future additions.
    d. All bolts, nuts, and washers shall be zinc-plated or cadmium-plated// steel.

B. Finish:
1. All metal surfaces shall be thoroughly cleaned, phosphatized and factory primed prior to applying baked enamel or lacquer finish.
2. Provide a light gray finish for indoor switchboard.
3. Outdoor switchboard:

a. Interior finish shall be light gray.
b. Exterior finishes shall be as specified in the Section 09 06 00 or other secton, SCHEDULE FOR FINISHES.
c. The underside of the switchboard shall be treated with corrosion resistant compounds, epoxy resin or rubberized sealing compound.

2.4 BUSES

A. Bus Bars and Interconnections:
1. Provide copper phase and neutral buses, fully rated for the amperage as shown on the drawings for the entire length of the switchboard. Bus laminations shall have a minimum of 6 mm (1/4 inch) spacing.
2. Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.
3. The bus and bus compartment shall be designed so that the acceptable NEMA standard temperature rises are not exceeded.
4. Install a copper ground bus the full length of the switchboard assembly.
5. Main Bonding Jumper: An un-insulated copper bus, size as shown on drawings, shall interconnect the neutral and ground buses, when the switchboard is used to establish the system common ground point.
6. All bolts, nuts, and washers shall be zinc-plated or cadmium-plated steel. Bolts shall be torqued to the values recommended by the manufacturer with a calibrated torque wrench.
7. Make provisions for future bus extensions by means of bolt holes or other approved method.

2.5 MAIN CIRCUIT BREAKERS

A. Type I or Type II Switchboards: Provide molded case main circuit breakers as shown on the drawings. Circuit breakers shall be the solid state adjustable trip type with power metering per Title 24.
1. Trip units shall have field adjustable tripping characteristics as follows:
a. Long time pickup.
b. Long time delay.
c. Short time pickup.

d. Short time delay.
e. Instantaneous.
f. Ground fault pickup (as shown in drawings).
g. Ground fault delay (as shown in drawings).

2. Breakers with same frame size shall be interchangeable with each other.
3. Breakers shall be fully rated if shown in the drawings.

B. Type II Switchboards: Provide main power circuit breakers as shown on the drawings. Circuit breakers shall be the solid state adjustable trip type with power metering as required by Title 24.

1. General: Circuit breakers larger than 1600A shall be dead front, drawout, stored energy type with solid state trip devices. Arcing contacts shall be renewable.
2. Rating: Circuit breakers shall be 3 pole, 600 V AC and below, 60 cycle with frame size, trip rating and functions, and system voltage as shown on drawings. Breakers shall have 30 cycle short time current ratings.
3. Drawout Mounting: Where required, provide a racking mechanism to position and hold the breaker in the connected, test, or disconnected position. Provide an interlock to prevent movement of the breaker into or out of the connected position unless the breaker is tripped open.
4. Trip Devices: Breakers shall be electrically and mechanically trip free and shall have trip devices in each pole. Unless otherwise indicated on drawings, each breaker shall have overcurrent and short-circuit and integral ground fault trip devices. Trip devices shall be of the solid state type with adjustable pick-up settings, with both long time and short time elements, and integral trip unit testing provisions where required for coordination and/or limiting arc-flash energy. Devices shall have time-delay band adjustment. Long-time delay element shall have inverse time characteristics. Main circuit breakers shall not have instantaneous trip function if it prevents correct coordination with downstream breakers.
5. Position Indicator: Provide a mechanical indicator visible from the front of the unit to indicate whether the breaker is open or closed.
6. Trip Button: Equip each breaker with a mechanical trip button accessible from the front of the door.
7. Padlocking: Provisions shall be included for padlocking the breaker in the open position.

8. Operation: Unless otherwise indicated herein or on the drawings, breakers shall be manually operated. Breakers larger than 1600 ampere frame size shall be electrically operated.

2.6 FEEDER CIRCUIT BREAKERS

A. Provide molded case circuit breakers as shown on the drawings.

B. Non-adjustable Trip Molded Case Circuit Breakers (as shown in drawings):
   1. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time characteristics, and instantaneous magnetic trip.
   2. Breaker features shall be as follows:
      a. A rugged, integral housing of molded insulating material.
      b. Silver alloy contacts.
      c. Arc quenchers and phase barriers for each pole.
      d. Quick-make, quick-break, operating mechanisms.
      e. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
      f. Electrically and mechanically trip free.
      g. An operating handle which indicates ON, TRIPPED, and OFF positions.
      h. Line and load connections shall be bolted.
      i. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open - handle ties shall not be acceptable.

C. Adjustable Trip Molded Case Circuit Breakers (as shown in drawings, where required for coordination):
   1. Provide molded case, solid state adjustable trip type circuit breakers.
   2. Trip units shall have field adjustable tripping characteristics as follows:
      a. Long time pickup.
      b. Long time delay.
      c. Short time pickup.
      d. Short time delay.
      e. Instantaneous.
      f. Ground fault pickup (as shown in drawings).
      g. Ground fault delay (as shown in drawings).

3. Breakers with same frame size shall be interchangeable with each other.

2.7 ELECTRIC UTILITY COMPANY EQUIPMENT

A. Provide separate compartment for electric utility company metering equipment as shown on drawings.
B. Provide suitable arrangements within the electric utility company metering compartment for mounting metering equipment. Obtain the electric utility company's approval of the compartment arrangements prior to fabrication of the switchboard.
C. Allow access to electric utility company personnel as required for installation of utility metering equipment.

2.8 SURGE PROTECTIVE DEVICES

A. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

2.9 METERING-OTHER THAN UTILITY METER – AS REQ. BY TITLE 24 AND DRAWINGS.

A. Refer to Section 25 10 10 if provided, ADVANCED UTILITY METERING. Refer to drawings for meter locations.
B. Provide current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.
C. Provide voltage transformers including primary fuses and secondary protective devices for metering as shown on the drawings.

2.10 OTHER EQUIPMENT

A. Furnish tools and accessories required for circuit breaker and switchboard test, inspection, maintenance, and proper operation.
B. Panelboards: Requirements for panelboards shown to be installed in the switchboard shall be as shown on the drawings and in Section 26 24 16, PANELBOARDS.

2.11 CONTROL WIRING

A. Switchboard control wires shall not be less than No. 14 AWG copper 600 volt rated. Install wiring complete at the factory, adequately bundled and protected. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

2.12 NAMEPLATES AND MIMIC BUS

A. Nameplates: For Normal Power system, provide laminated black phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. For Essential Electrical System, provide laminated red phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings. Nameplates shall be mounted with plated screws on front of breakers or on equipment enclosure next to breakers. Mounting nameplates only with adhesive is not acceptable.

B. Mimic Bus, if required: Provide an approved mimic bus on front of each switchboard assembly. Color shall be black for the Normal Power system and red for the Essential Electrical System, either factory-painted plastic or metal strips. Plastic tape shall not be used. Use symbols similar to one line diagram shown on drawings. Plastic or metal strips shall be mounted with plated screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboards in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Anchor switchboards with rustproof bolts, nuts, and washers not less than 13 mm (1/2 inch) diameter, in accordance with manufacturer's instructions, and as shown on drawings. Mark all anchor positions and drill concrete prior to setting switchboard. Drilling through the switchboard shall not be permitted.

C. In seismic areas, switchboards shall be adequately anchored and braced per details on structural contract drawings and manufacturer's seismic installation instructions to withstand the seismic forces at the location where installed.

D. Exterior Location. Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 12.5 mm (1/2 inch) chamfer. The slab shall be of

adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit risers and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as on specified on the Structural Drawings.

E. Interior Location. Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 100 mm (4 inches) thick. The top of the concrete slab shall be approximately 100 mm (4 inches) above finished floor. Edges above floor shall have 12.5 mm (1/2 inch) chamfer. The slab shall be sized to project not more than 5 inches beyond the equipment. Provide conduit risers and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified on the Structural Drawiings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
    a. Compare equipment nameplate data with specifications and approved shop drawings.
    b. Inspect physical, electrical, and mechanical condition.
    c. Verify appropriate anchorage, required area clearances, and correct alignment.
    d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
    e. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
    f. Confirm correct operation and sequencing of any key-type mechanical interlock systems.
    g. Vacuum-clean switchboard enclosure interior. Clean switchboard enclosure exterior.
    h. Inspect insulators for evidence of physical damage or contaminated surfaces.
    i. Verify correct shutter installation and operation.
    j. Exercise all active components.

k. Verify the correct operation of all sensing devices, alarms, and indicating devices.
l. Verify that vents are clear.

2. Electrical tests:
   a. Perform insulation-resistance tests on each bus section.
   b. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
   c. Perform phasing check on double-ended switchboards to ensure correct bus phasing from each source.

B. Prior to the final inspection for acceptance, a technical representative from the electric utility company shall witness the testing of the equipment to assure the proper operation of the individual components, and to confirm proper operation/coordination with electric utility company's equipment.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the switchboard is in good operating condition and properly performing the intended function.

3.4 WARNING SIGN

A. Mount on each entrance door of the outdoor switchboard enclosure or switchboard room, approximately 1500 mm (5 feet) above grade or floor**,** a clearly lettered warning sign for warning personnel. The sign shall be attached with rustproof metal screws.

3.5 ONE LINE DIAGRAM AND SEQUENCE OF OPERATION

A. At final inspection, an as-built one line diagram shall be laminated or mounted under acrylic glass, and installed in a frame mounted in the switchboard room or in the outdoor switchboard enclosure.

B. Furnish a written sequence of operation for the switchboard and connected line side/load side electrical distribution equipment. The sequence of operation shall be laminated or mounted under acrylic glass, and installed in a frame mounted in the switchboard room or in the outdoor switchboard enclosure.

C. Deliver an additional four copies of the as-built one line diagram and sequence of operation to the Engineer.

3.6 AS-LEFT TRIP UNIT SETTINGS

A. The trip unit settings shall be set in the field by an authorized representative of the switchboard manufacturer per the approved Electrical System Protective Device Study in accordance with Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY.

B. Post a durable copy of the "as-left" trip unit settings in a convenient location in the switchboard room or outdoor switchboard enclosure. Deliver four additional copies of the settings to the Engineer. Furnish this information prior to the activation of the switchboard.

3.7 INSTRUCTION

A. Furnish the services of a factory-trained technician for one, 4-hour training period for instructing personnel in the maintenance and operation of the switchboards, on the date requested by the Engineer.

---END of SECTION---

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
E. Section 26 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.
F. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective devices integral to panelboards.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
    1. Shop Drawings:
        a. Submit sufficient information to demonstrate compliance with drawings and specifications.
        b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.

c. Certification from the manufacturer that a representative panelboard has been seismically tested to California Building Code (IBC) requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by anecdotal data or other informal methods.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.
      1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
      2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. International Code Council (ICC):
   IBC-12 ..... International Building Code (California Building Code)

C. National Electrical Manufacturers Association (NEMA):
   PB 1-11 ..... Panelboards
   250-08 ..... Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
   70-11 ..... National Electrical Code (NEC)(California Electrical Code)
   70E-12 ..... Standard for Electrical Safety in the Workplace

E. Underwriters Laboratories, Inc. (UL):
50-95..... Enclosures for Electrical Equipment
67-09..... Panelboards
489-09..... Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.
B. Panelboards shall have main breaker or main lugs, bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.
C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.
D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.
E. Bus bar connections to the branch circuit breakers shall be the “distributed phase” or “phase sequence” type.
F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they will be connected.
G. Neutral bus shall be //100%//200%//rated, mounted on insulated supports.
H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.
I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.
J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.
K. Series-rated panelboards are not permitted.

2.2 ENCLOSURES AND TRIMS

A. Enclosures:
   1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
   2. Enclosures shall not have ventilating openings.
   3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
   4. Provide manufacturer's standard option for pre-punched knockouts on top and bottom end-walls.
   5. Include removable inner dead front cover, independent of the panelboard cover.

B. Trims:
   1. Hinged "door-in-door" type.
   2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
   3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
   4. Inner and outer doors shall open left to right.
   5. Trims shall be flush or surface type as shown on the drawings.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.

B. Circuit breakers shall be bolt-on type.

C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
   1. 120/208 V Panelboard: 10,000 A symmetrical.
   2. 120/240 V Panelboard: 10,000 A symmetrical.
   3. 277/480 V Panelboard: 14,000 A symmetrical.

Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Overcurrent Protective Devices shall be coordinated.

E. Circuit breaker features shall be as follows:
   1. A rugged, integral housing of molded insulating material.
   2. Silver alloy contacts.
   3. Arc quenchers and phase barriers for each pole.
   4. Quick-make, quick-break, operating mechanisms.
   5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
   6. Electrically and mechanically trip free.
   7. An operating handle which indicates closed, tripped, and open positions.
   8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
   9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.

2.4 SURGE PROTECTIVE DEVICES

A. Where shown on the drawings, furnish panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected.

C. In seismic areas, panelboards shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Install a printed schedule of circuits in each panelboard after approval by the Engineer. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards

E. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).
F. Provide blank cover for each unused circuit breaker mounting space.
G. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims with finishes to match surrounding surfaces after the panelboards have been installed. Do not paint nameplates.//
H. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to other enclosures or devices.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify appropriate anchorage and required area clearances.
      d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
      e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
      f. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

---END of SECTION---

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
    1. Shop Drawings:
        a. Submit sufficient information to demonstrate compliance with drawings and specifications.
        b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
    2. Manuals:

a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)(California Electrical Code)

99-12 ..... Health Care Facilities

C. National Electrical Manufacturers Association (NEMA):

WD 1-10 ..... General Color Requirements for Wiring Devices

WD 6-08 ..... Wiring Devices – Dimensional Specifications

D. Underwriter's Laboratories, Inc. (UL):

5-11 ..... Surface Metal Raceways and Fittings

20-10 ..... General-Use Snap Switches

231-07 ..... Power Outlets

467-07 ..... Grounding and Bonding Equipment

498-07 ..... Attachment Plugs and Receptacles

943-11 ..... Ground-Fault Circuit-Interrupters

1449-07 ..... Surge Protective Devices

1472-96 ..... Solid State Dimming Controls

E. Most Recent California Energy Commission Title 24 – lighting and power controls:

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.

B. Duplex Receptacles: Specification-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation (required by Title 24).
   1. Bodies shall be ivory in color or as shown on plans and agreed in approved submittals.
   2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
   3. Duplex Receptacles on Emergency Circuit:
      a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
   4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, specification-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face if wiring is detected as incorrect.
      a. Ground fault circuit interrupter (GFCI) shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
   5. Safety Type Duplex Receptacles:
      a. Bodies shall be gray in color.
         1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
         2) Screws exposed while the wall plates are in place shall be the tamperproof type.

C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall with factory components to produce watertight mating surfaces.

E. Surge Protective Device (SPD) Receptacles shall have integral surge suppression in line to ground, line to neutral, and neutral to ground modes.
   1. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 Volts and minimum single transient pulse energy dissipation of 210 Joules.
   2. Active SPD Indication: LED, visible in face of device to indicate device is active or no longer in service.

F. Cable Reel Receptacles:
   1. Reel shall have a heavy-duty spring motor, with self-contained rewind power and non-sparking ratchet assembly, a 4-way roller and adjustable cable stop, and a safety chain. Reel shall lock when desired cable has been payed out, and unlock and retract when cable is pulled to release lock.
   2. Reel shall be provided with minimum 40 foot [12m] cable rated as shown in drawings with required phase conductors, neutral, and equipment grounding conductor. Provide device with NEMA configuration as shown in drawings.

2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
   1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
   2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captive binding screws.

3. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 MANUAL DIMMING CONTROL

A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.

B. Manual dimming controls shall be fully compatible with //fluorescent electronic dimming ballasts and approved by the ballast manufacturer// //LED dimming driver and be approved by the driver manufacturer//, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

C. Provide single-pole or three-way, as shown on the drawings.

D. Manual dimming control and faceplates shall be ivory in color unless otherwise specified.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel in mechanical, damp or wet areas, or smooth nylon. Oversize plates are not acceptable.

B. Color shall be ivory unless otherwise specified.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters. In wet or damp areas wall plates shall be type 302 stainless steel, with the word “EMERGENCY” engraved in 6 mm (1/4 inch) red letters.

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

A. Shall have the following features:

1. Enclosures:

a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3-1/2 square inches).

The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.

2. Receptacles shall be duplex, specification grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.
4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.
5. Installation fittings shall be the manufacturer’s standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
6. Bond the assemblies to the branch circuit conduit system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.
B. Install wiring devices after wall construction and painting is complete.
C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
E. Provide barriers in multigang outlet boxes to comply with the NEC.
F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
I. Install wall dimmers 1.2 M (48 inches) above floor.

J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

K. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.

L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:
    a. Inspect physical and electrical condition.
    b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
    c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
    d. Test GFCI receptacles.
2. Healthcare Occupancy Tests:
    a. Test any hospital grade receptacles for retention force per NFPA 99.

---END of SECTION---

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of Type 2 Surge Protective Devices, as defined in NFPA 70, and indicated as transient voltage surge suppression or TVSS in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
B. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: For factory-installed or external TVSS.
C. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: For factory-installed or external TVSS.
D. Section 26 24 16, PANELBOARDS: For factory-installed or external TVSS.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
    1. Shop Drawings:
        a. Submit sufficient information to demonstrate compliance with drawings and specifications.
        b. Include electrical ratings and device nameplate data.
    2. Manuals:
        a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
        b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the TVSS conforms to the requirements of the drawings and specifications and conforms to the latest published UL specification for the application.
   b. Certification by the Contractor that the SPDs have been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

IEEE C62.41.2-02 ..... Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.45-03 ..... Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

C. National Fire Protection Association (NFPA):

70-11..... National Electrical Code (NEC)(California Electrical Code)

D. Underwriters Laboratories, Inc. (UL):

UL 1283-05 ..... Electromagnetic Interference Filters

UL 1449-06 ..... Surge Protective Devices (most recent version)

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD SPD

A. General Requirements:
   1. Comply with IEEE and UL.
   2. Modular design with field-replaceable modules, or non-modular design.
   3. Fuses, rated at 200 kA interrupting capacity.
   4. Bolted compression lugs for internal wiring.
   5. Integral disconnect switch.
   6. Redundant suppression circuits.
   7. LED indicator lights for power and protection status.
   8. Audible alarm, with silencing switch, to indicate when protection has failed.

9. Form-C contacts rated at 5A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter
11. Multi-year guaranty – two year minimum

B. Surge Current per Phase: Minimum 240kA per phase for main bus, 80kA for 120V lighting panels. RVSS and VFD's shall have minimum kA rating of 80kA SPDs..

2.2 PANELBOARD SPD

A. General Requirements:
1. Comply with UL 1449 and IEEE C62.41.2.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.
11 Multi-year guaranty – two year minimum.

B. Surge Current per Phase: Minimum 120kA per phase.

2.3 ENCLOSURES

A. Enclosures: NEMA 1, 3R, as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Factory-installed: Switchgear, switchboard, or panelboard manufacturer shall install SPD at the factory.

B. Field-installed SPD: Contractor shall install SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
   1. Provide a circuit breaker as a dedicated disconnecting means for SPD if shown on drawings or in manufacturer’s installation instructions. Install with shortest possible wiring path from SPD to breaker to power bus.

C. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests, and reconnect SPD immediately after insulation resistance tests are complete.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify that disconnecting means and feeder size and maximum length to TVSS corresponds to approved shop drawings.
      d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
      e. Vacuum-clean enclosure interior. Clean enclosure exterior.
      f. Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that TVSS are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the TVSS, on the date requested by the Engineer.

---END of SECTION---

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms “lighting fixture,” “fixture,” and “luminaire” are used interchangeably.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems per CEC Title 24.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
    a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
    b. Material and construction details, include information on housing and optics system.
    c. Physical dimensions and description.
    d. Wiring schematic and connection diagram.
    e. Installation details.

f. Energy efficiency data.
g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
h. Light source data including lumen output (initial and mean), color rendition index (CRI, CCT), rated life (hours), and color temperature (degrees Kelvin).
i. Ballast/power supply data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American National Standards Institute (ANSI):

C78.1-91 ..... Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics

C78.376-01 ..... Chromaticity of Fluorescent Lamps

C. American Society for Testing and Materials (ASTM):

C635-07 ..... Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

D. Environmental Protection Agency (EPA):

40 CFR 261..... Identification and Listing of Hazardous Waste

E. Federal Communications Commission (FCC):

CFR Title 47, Part 15..... Radio Frequency Devices

CFR Title 47, Part 18..... Industrial, Scientific, and Medical Equipment

F. Illuminating Engineering Society (IES):

LM-79-08..... Electrical and Photometric Measurements of Solid-State Lighting Products

LM-80-08..... Measuring Lumen Maintenance of LED Light Sources

LM-82-12..... Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

G. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91 ..... Surge Voltages in Low Voltage AC Power Circuits

H. International Code Council (ICC):

IBC-12..... International Building Code

I. National Fire Protection Association (NFPA):

70-11..... National Electrical Code (NEC)(California Electrical Code)

101-12..... Life Safety Code

J. National Electrical Manufacturer's Association (NEMA):

C82.1-04 ..... Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts

C82.2-02 ..... Method of Measurement of Fluorescent Lamp Ballasts

C82.4-02 ..... Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)

C82.11-11 ..... Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts

LL-9-09..... Dimming of T8 Fluorescent Lighting Systems

SSL-1-10..... Electronic Drivers for LED Devices, Arrays, or Systems

K. Underwriters Laboratories, Inc. (UL):

496-08..... Lampholders

542-0599..... Fluorescent Lamp Starters

844-12 ..... Luminaires for Use in Hazardous (Classified) Locations

924-12 ..... Emergency Lighting and Power Equipment

935-01 ..... Fluorescent-Lamp Ballasts

1029-94 ..... High-Intensity-Discharge Lamp Ballasts

1029A-06..... ..... Ignitors and Related Auxiliaries for HID Lamp Ballasts

1598-08 ..... Luminaires

1574-04..... ..... Track Lighting Systems

2108-04..... ..... Low-Voltage Lighting Systems

8750-09..... ..... Light Emitting Diode (LED) for Use in Lighting Products

L. California Energy Commission

Title 24	Lighting and Power Management and Control – All fixtures and controls shall be CEC certified.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

1. Fluorescent: Single slot entry type, requiring a one-quarter turn of the lamp after insertion. Lampholder contacts shall be the biting edge type.
2. Compact Fluorescent: 4-pin.
3. High Intensity Discharge (HID): Porcelain.

E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:
   1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
   2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
   3. Exterior finishes shall be as shown on the drawings.

H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:
   1. Shall be 100 percent virgin acrylic.
   2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
   3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures.

2.2 BALLASTS

A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V), electronic programmed-start or rapid-start type, designed for type and quantity of lamps indicated. Ballasts shall

be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:

1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion (THD): 10 percent or less.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.87 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. EMR/RFI Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
13. Dimming ballasts shall be as per above, except dimmable from 100% to 5% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.

C. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V), electronic programmed rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.

3. Sound Rating: Class A.
4. Total Harmonic Distortion (THD): 10 percent or less.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Ballast Factor: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
11. Dimming ballasts shall be as per above, except dimmable from 100% to 5/% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.

D. Ballasts for HID fixtures: Multi-tap voltage (120 – 480V) electromagnetic ballast for high intensity discharge lamps. Include the following features unless otherwise indicated:
   1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
   2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
   3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
   4. Open-circuit operation that will not reduce average life.
   5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise (only electronic ballast are allowed).

E. Electronic ballast for HID metal-halide lamps shall include the following features unless otherwise indicated:
   1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
   2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
   3. Lamp end-of-life detection and shutdown circuit.
   4. Sound Rating: Class A.
   5. Total Harmonic Distortion (THD): 20 percent or less.
   6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
   7. Lamp Current Crest Factor: 1.5 or less.

8. Power Factor: 0.90 or higher.
9. Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
10. Protection: Resettable thermal.

2.3 FLUORESCENT EMERGENCY BALLAST

A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture housing and compatible with ballast.
   1. Emergency Connection: Operate one fluorescent lamp continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
   2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   3. Battery: Sealed, maintenance-free, nickel-cadmium type or Li-on lithium.
   4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 EMERGENCY LIGHTING UNIT

A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch.
   1. Enclosure: Shall be impact-resistant thermoplastic. Enclosure shall be suitable for the environmental conditions in which installed.
   2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
   3. Lamps: Shall be LED and shall be equivalent lumens and beam to an MR-16 halogen that is rated not less than 12 watts at the specified DC voltage.

4. Battery: Shall be maintenance-free nickel-cadmium or Li-on lithium. Normal rated life shall be minimum of 10 years.
5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.5 LAMPS

A. Linear and U-shaped T5 and T8 Fluorescent Lamps:
   1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3000° and 3500°K, a Color Rendering Index (CRI) equal or greater than 85, average rated life equal to or greater than 24,000 hours when used with an instant start ballast and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.
   2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

B. Compact Fluorescent Lamps:
   1. T4, CRI 80 (minimum), color temperature 2800-3200°K, average rated life equal to or greater than 12,000 hours (based on 3 hour starts), and suitable for use with dimming ballasts, unless otherwise indicated.
   2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

C. High Intensity Discharge Lamps:
   1. High-Pressure Sodium Lamps: CRI 21 (minimum), color temperature 1900°K, and average rated life of 24,000 hours.
      a. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.
   2. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65 (minimum), color temperature 4000°K, and average rated life of 15,000 hours (based on 10 hour starts).

3. Ceramic, Pulse-Start, Metal-Halide Lamps: CRI 80 (minimum), color temperature 4000°K, and average rated life of 12,000 hours (based on 10 hour starts).

2.6 RADIO-INTERFERENCE-FREE FLUORESCENT FIXTURES - WHERE REQUIRED

A. Shall be specially designed for suppressing radio-frequency energy produced within the fixtures, and shall comply with Department of Defense MIL-STD-461F and IEC IP65.
B. Lenses shall have metal mesh to prevent or reduce radio-frequency interference. The effective light transmittance of the lenses shall be a minimum of 75 percent.
C. Fixture finish shall be anti-microbial.
D. Provide RFI line filters integral to the fixtures and wired in series with the supply circuit conductors.
E. Ballasts shall be as specified in this Section.

2.7 LED EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
B. Housing and door shall be die-cast aluminum.
C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
D. Finish shall be satin or fine-grain brushed aluminum.
E. There shall be no radioactive material used in the fixtures.
F. Fixtures:
    1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
    2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
    3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
G. Voltage: Multi-voltage (120 – 277V).

2.8 LED LIGHT FIXTURES

A. General:
   1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
   2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
   3. LED drivers shall include the following features unless otherwise indicated:
      a. Minimum efficiency: 85% at full load.
      b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
      c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
      d. Integral short circuit, open circuit, and overload protection.
      e. Power Factor: ≥ 0.95.
      f. Total Harmonic Distortion: ≤ 20%.
      g. Comply with FCC 47 CFR Part 15.
   4. LED modules shall include the following features unless otherwise indicated:
      a. Comply with IES LM-79 and LM-80 requirements.
      b. Minimum CRI 80 and color temperature 3000 K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
      c. Minimum Rated Life: 50,000 hours per IES L70.
      d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:
   1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:
   1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
   2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.

B. Align, mount, and level the lighting fixtures uniformly.

C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.

D. Lighting Fixture Supports:
   1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
   2. Shall maintain the fixture positions after cleaning and relamping.
   3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
   4. Hardware for recessed fluorescent fixtures:
      a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
      b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
   5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
      a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
   6. Hardware for recessed lighting fixtures:
      a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
      b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass

through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.

c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
   1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
   2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

7. Surface mounted lighting fixtures:
   a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
   b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
   c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
      1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

8. Single or double pendant-mounted lighting fixtures:
   a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.//

E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.

F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.

G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Owner.

I. Dispose of lamps per requirements of Section 01 74 19 or other section, CONSTRUCTION WASTE MANAGEMENT.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:
   1. Visual Inspection:
      a. Verify proper operation by operating the lighting controls.

b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.

2. Electrical tests:
   a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the Engineer. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Owner.
   b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by the Owner. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps, ballasts, LEDs or power supplies which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

---END of SECTION---

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

F. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
b. Material and construction details, include information on housing and optics system.
c. Physical dimensions and description.
d. Wiring schematic and connection diagram.
e. Installation details.
f. Energy efficiency data.
g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
h. Light source data including lumen output (initial and mean), color rendition index (CRI, CCT), rated life (hours), and color temperature (degrees Kelvin – shall be lower than 4,000K).
i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
k. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Overlay on TTAD site plan (TTAD will supply) shall show computer generated point–by-point illumination calculations. Include lamp lumen and light loss factors used in calculations. Show this for all outside fixtures, pole and wall mounted and bollard type.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Aluminum Association Inc. (AA):
AAH35.1-06..... Alloy and Temper Designation Systems for Aluminum

C. American Association of State Highway and Transportation Officials (AASHTO):
32-LTS-6 ..... Structural Supports for Highway Signs, Luminaires and Traffic Signals

D. American Concrete Institute (ACI):
318-05 ..... Building Code Requirements for Structural Concrete

E. American National Standards Institute (ANSI):
C81.61-09 ..... Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps

F. American Society for Testing and Materials (ASTM):
A123/A123M-12 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-09 ..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B108-03a-08 ..... Aluminum-Alloy Permanent Mold Castings
C1089-13 ..... Spun Cast Prestressed Concrete Poles

G. Federal Aviation Administration (FAA):
AC 70/7460-IK-07..... Obstruction Lighting and Marking
AC 150/5345-43F-06..... Obstruction Lighting Equipment

H. Illuminating Engineering Society of North America (IESNA):
HB-9-00..... Lighting Handbook
RP-8-05..... Roadway Lighting
LM-52-03..... Photometric Measurements of Roadway Sign Installations
LM-72-10..... Directional Positioning of Photometric Data

LM-79-08..... Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products

LM-80-08..... Approved Method for Measuring Lumen Maintenance of LED Light Sources

TM-15-07..... Backlight, Uplight and Glare (BUG) Ratings

I. National Electrical Manufacturers Association (NEMA):

C78.41-06 ..... Electric Lamps – Guidelines for Low-Pressure Sodium Lamps

C78.42-07 ..... Electric Lamps – Guidelines for High-Pressure Sodium Lamps

C78.43-07 ..... Electric Lamps – Single-Ended Metal-Halide Lamps

C78.1381-98..... Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps

C82.4-02 ..... Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

C136.3-05 ..... For Roadway and Area Lighting Equipment – Luminaire Attachments

C136.17-05 ..... Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors

ICS 2-00 (R2005) ..... Controllers, Contactors and Overload Relays Rated 600 Volts

ICS 6-93 (R2006) ..... Enclosures

J. National Fire Protection Association (NFPA):

70-11 ..... National Electrical Code (NEC)

K. Underwriters Laboratories, Inc. (UL):

496-08 ..... Lampholders

773-95..... Plug-In, Locking Type Photocontrols for Use with Area Lighting

773A-06 ..... Nonindustrial Photoelectric Switches for Lighting Control

1029-94..... High-Intensity-Discharge Lamp Ballasts

1598-08 ..... Luminaires

8750-09..... ..... Light Emitting Diode (LED) Equipment for Use in Lighting Products

L. California Energy Commission

Title 24 — Lighting and Power Management and Control – All fixtures and controls shall be CEC certified.

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LUMINAIRES

A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping (or replacement of LED light assemblies and LED power supplies). Interior compartments behind lenses housing light sources and reflectors shall be completely bug-proof even after re-lamping when installation instructions are followed.

B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings or as required to produce required performance including cutoff, minimum/maximum lighting levels, minimum average levels, minimum min/max ratios, etc. Unless specifically allowed or installed where no radiation above the horizon is possible, all fixtures shall be dark-sky compliant.

C. Incorporate ballasts or power supplies in the luminaire housing, except where otherwise shown on the drawings.

D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire

housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61-09 and UL 496-08.

F. Pre-wire internal components to terminal strips at the factory.

G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.

H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES or as shown in approved submittals.

J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.3 LAMPS

A. Install the proper lamps in every luminaire installed and every existing luminaire relocated or reinstalled as shown on the drawings.

B. Lamps shall be general-service, outdoor lighting types.

C. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
2. Correlated Color Temperature (CCT): 2700K to not higher than-4000K or as shown in fixtures schedule.
3. Color Rendering Index (CRI): $\geq$ 85.
4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.//

D. Mercury vapor lamps shall not be used.

2.4 LED DRIVERS

A. LED drivers shall meet the following requirements:
   1. Drivers shall have a minimum efficiency of 85%.
   2. Starting Temperature: -40 degrees C (-40 degrees F).
   3. Input Voltage: 120 to 480 (±10%) volt.
   4. Power Supplies: Class I or II output.
   5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
   6. Power Factor (PF): ≥ 0.90.
   7. Total Harmonic Distortion (THD): ≤ 20%.
   8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
   9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.5 EXISTING LIGHTING SYSTEMS

A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
B. New poles and luminaires shall have approximately the same configurations, dimensions, lamping and reflector type as the existing poles and luminaires, except where otherwise shown on the drawings.

2.6 OBSTRUCTION LIGHTING – WHERE REQUIRED

A. Refer to Section 26 09 23, LIGHTING CONTROLS for control devices.
B. For Buildings:
   1. Incandescent type luminaires shall comply with FAA, AC 70/7460-1K, and AC 150/5345-53, and be Type L-810 duplex units with red Fresnel lenses and steady burning 100 W, type A-21, clear, traffic-signal lamps in each unit.
   2. LED type luminaires shall comply with FAA, AC 70/7460-1K, and AC 150/5345-53, and be Type L-810 duplex units with red steady burning light from and LED light source with minimum 50,000 hour lamp life and employing Night Vision Goggles (NVG) friendly technology.

3. Mount the luminaires on galvanized rigid steel pipe masts attached to the roof of the buildings so the luminaires extend 305 mm (12 inches) above the level of the highest item on the building, including items attached to the roof.
4. Locate luminaires in accordance with the applicable FAA Standards.

C. For Smoke Stacks: Luminaires shall be in accordance with the referenced details shown on the drawings. All lamps shall be the type shown on the drawings.

D. For Water Tanks and Cooling Towers: Luminaires shall be FAA, AC 70/7460-1K, and AC 150/5345-53, Type L-810 duplex units with incandescent or LED light source.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Pole Foundations:

1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.
2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
3. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
4. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 9 mm (0.375-inch) inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.

C. Install lamps in each luminaire.

D. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

3.4 WATER TANKS AND COOLING TOWERS

Mount the luminaires at the extreme top of tank and tower as shown on drawings.

- - - END of SECTION - - -

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 1 of 6)
Project Name:	Date Prepared: 12/13/2016

A. General Information						
Climate Zone: 16	Conditioned Floor Area : 0					
	Unconditioned Floor Area : 3,570					
Building Type:	☐	Nonresidential	☐	High-Rise Residential	☐	Hotel/Motel
☐ Schools	☐	Relocatable Public Schools	☐	Conditioned Spaces	☑	Unconditioned Spaces
Phase of Construction:	☑	New Construction	☐	Addition	☐	Alteration
Method of Compliance:	☐	Complete Building	☑	Area Category	☐	Tailored
Project Address:						

B. Lighting Compliance Documents (select yes for each document included)

For detailed instructions on the use of this and all Energy Efficiency Standards compliance documents, refer to the Nonresidential Manual published by the California Energy Commission.

YES	NO	FORM	TITLE
✔		NRCC-LTI-01-E	Certificate of Compliance. All Pages required on plans for all submittals.
✔		NRCC-LTI-02-E	Lighting Controls, Certificate of Compliance, and PAF Calculation. All Pages required on plans for all submittals.
✔		NRCC-LTI-03-E	Indoor Lighting Power Allowance
	✔	NRCC-LTI-04-E	Tailored Method Worksheets
	✔	NRCC-LTI-05-E	Line Voltage Track Lighting Worksheets

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 2 of 6)
Project Name:	Date Prepared: 12/13/2016

C. Summary of Allowed Lighting Power

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
1.	**Installed** Lighting NRCC-LTI-01-E, page 4	+	0		**Installed** Lighting NRCC-LTI-01-E, page 4	+	1,596
2.	PORTABLE ONLY FOR OFFICES NRCC-LTI-01-E, page 3	+					
3.	Minus Lighting Control Credits NRCC-LTI-02-E, page 2	-	0		Minus Lighting Control Credits NRCC-LTI-02-E, page 2	-	0
4.	Adjusted **Installed** Lighting Power (row 1 plus row 2 minus row 3)	=	0		Adjusted **Installed** Lighting Power (row 1 minus row 3)	=	1,596
5.	Complies ONLY if **Installed** ≤ **Allowed**				Complies ONLY if **Installed** ≤ **Allowed**		
6.	**Allowed** Lighting Power Conditioned NRCC-LTI-03-E, page 1		0		**Allowed** Lighting Power Unconditioned NRCC-LTI-03-E, page 1		3,570

D. Declaration of Required Installation Certificates

Declare by selecting yes for all Installation Certificates that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Form/Title	
✔		NRCI-LTI-01-E - Must be submitted for all buildings	☐ Field Inspector
	✔	NRCI-LTI-02-E - Must be submitted for a lighting control system, or for an Energy Management Control System (EMCS), to be recognized for compliance.	☐ Field Inspector
	✔	NRCI-LTI-03-E - Must be submitted for a line-voltage track lighting integral current limiter, or for a supplementary overcurrent protection panel used to energize only line-voltage track lighting, to be recognized for compliance.	☐ Field Inspector
	✔	NRCI-LTI-04-E - Must be submitted for two interlocked systems serving an auditorium, a convention center, a conference room, a multipurpose room, or a theater to be recognized for compliance.	☐ Field Inspector
	✔	NRCI-LTI-05-E - Must be submitted for a Power Adjustment Factor (PAF) to be recognized for compliance.	☐ Field Inspector
	✔	NRCI-LTI-06-E - Must be submitted for additional wattage installed in a video conferencing studio to be recognized for compliance.	☐ Field Inspector

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 3 of 6)
Project Name:	Date Prepared: 12/13/2016

E. Declaration of Required Certificates of Acceptance

Declare by checking all of the Certificates of Acceptance that will be submitted. (Retain copies and verify forms are completed and signed.)

YES	NO	Form/Title	
✔		NRCA-LTI-02-A - Must be submitted for occupancy sensors and automatic time switch controls.	☐ Field Inspector
	✔	NRCA-LTI-03-A - Must be submitted for automatic daylight controls.	☐ Field Inspector
	✔	NRCA-LTI-04-A - Must be submitted for demand responsive lighting controls.	☐ 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**

F. Indoor Lighting Schedule and Field Inspection Energy Checklist

☐ The actual indoor lighting power listed on this page and on the next page includes all installed permanent and planned portable lighting systems.

☐ When Complete Building Method is used for compliance, list each different type of luminaire on separate lines.

☐ When Area Category Method or Tailored Method is used for compliance, list each different type of luminaire by each different function area on separate lines

☐ Also include track lighting in schedule, and submit the track lighting compliance form (NRCC-LTI-05-E) when line-voltage track lighting is installed.

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 4 of 6)
Project Name:	Date Prepared: 12/13/2016

G. Installed Portable Luminaires in Offices – Exception to Section 140.6(a)

☐ This section shall be filled out ONLY for portable luminaires in offices (As defined in §100.1). All other planned portable luminaires shall be documented on next page of this compliance form.

☐ This section is used to determine if greater than 0.3 watts of portable lighting is planned for any office

☐ Fill out a separate line for each different office. Small offices that are typical (having the same general and portable lighting) may be grouped together. This allowance shall not be traded between offices having different lighting systems.

Office Portable Luminaire Schedule	Office Installed Portable Luminaire Watts Per Square Foot							Office Location	Field Inspector	
1	2	3	4	5	6	7	8	9	10	
Complete Luminaire Description (i.e., LED, under cabinet, furniture mounted direct/indirect)	Watts per Luminaire	Number of Luminaires	Installed portable luminaire watts in this office (G02 x G03)	Square feet of this office	Watts per square foot (G04 / G05)	If F ≤ 0.3, enter zero; if G06 > 0.3, (G06-0.3)	G05 x G07	Identify Office area in which these portable luminaires are installed	Pass	Fail
									☐	☐
									☐	☐
									☐	☐
									☐	☐
									☐	☐
Total installed portable luminaire watts that are greater than 0.3 watts per square foot per office:								Enter sum total of all pages into NRCC-LTI-01-E; Page 1		

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 5 of 6)
Project Name:	Date Prepared: 12/13/2016

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**

H. INDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Luminaire Schedule		Installed Watts				Location	Field Inspector [1]	
A	B	C	D		E	F	G	H	
Name or Item Tag	Complete Luminaire Description (i.e, 3 lamp fluorescent troffer, F32T8, one dimmable electronic ballast)	Watts per Luminaire	How wattage was determined: CEC Default from NA8	How wattage was determined: According to §130.0(c)	Number Luminaires	Total Installed Watts in this area (H03 x H05)	Primary Function area in which these luminaires are installed	Pass	Fail
L1	L1 Highbay LED	95.0	☑	☐	12	1,140	Industrial Work, High Bay	☐	☐
L2	L2 Lowbay LED	38.0	☑	☐	12	456	Industrial Work, High Bay	☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			☐	☐				☐	☐
			INSTALLED WATTS PAGE TOTAL:			1,596	Enter sum total of all pages into NRCC-LTI-01-E; Page 2		

CERTIFICATE OF COMPLIANCE	NRCC-LTI-01-E
Indoor Lighting	(Page 6 of 6)
Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name: Weld Fickel	Documentation Author Signature: 
Company: Sugarpine Engineering, Inc	Signature Date: 12/13/2016
Address: 12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):
City/State/Zip: Truckee, CA 96161	Phone: 530-214-0859

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip: ,	Phone:

CERTIFICATE OF COMPLIANCE	NRCC-LTI-02-E
Indoor Lighting - Lighting Controls	(Page 1 of 3)
Project Name:	Date Prepared: 12/13/2016

The NRCC-LTI-02-E shall be used to document all mandatory and prescriptive lighting controls that are applicable to the project.

Mandatory Lighting Control Declaration Statements (Indicate if the measure applies by checking yes or no below.)

YES	NO	Control Requirements
✔		Lighting shall be controlled by self-contained lighting control devices which are certified to the Energy Commission according to the Title 20 Appliance Efficiency Regulations in accordance with Section 110.9.
	✔	Lighting shall be controlled by a lighting control a system or energy management control system in accordance with §110.9. An Installation Certificate shall be submitted in accordance with Section 130.4(b).
	✔	One or more Track Lighting Integral Current Limiters shall be installed which have been certified to the Energy Commission in accordance with §110.9 and §130.0. Additionally, an Installation Certificate shall be submitted in accordance with Section 130.4(b).
	✔	A Track Lighting Supplementary Overcurrent Protection Panel shall be installed in accordance with Section 110.9 and Section 130.0. Additionally, an Installation Certificate shall be installed in accordance with Section 130.4(b).
✔		All lighting controls and equipment shall comply with the applicable requirements in §110.9 and shall be installed in accordance with the manufacturer's instructions in accordance with Section 130.1.
✔		All luminaires shall be functionally controlled with manually switched ON and OFF lighting controls in accordance with Section 130.1(a).
✔		General lighting shall be separately controlled from all other lighting systems in an area. Floor and wall display, window display, case display, ornamental, and special effects lighting shall each be separately controlled on circuits that are 20 amps or less. When track lighting is used, general, display, ornamental, and special effects lighting shall each be separately controlled; in accordance with Section 130.1(a)4.
✔		The general lighting of any enclosed area 100 square feet or larger, with a connected lighting load that exceeds 0.5 watts per square foot shall meet the multi-level lighting control requirements in accordance with Section 130.1(b).
✔		All installed indoor lighting shall be equipped with controls that meet the applicable Shut-OFF control requirements in Section 130.1(c).
	✔	Lighting in all Daylit Zones shall be controlled in accordance with the requirements in Section 130.1(d) and daylit zones are shown on the plans.
	✔	Lighting power in buildings larger than 10,000 square feet shall be capable of being automatically reduced in response to a Demand Responsive Signal in accordance with Section 130.1(e).
✔		Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with Section 130.4.(a). The controls required to meet the Acceptance Requirements include automatic daylight controls, automatic shut-OFF controls, and demand responsive controls.

A separate document must be filled out for Conditioned and Unconditioned Spaces. This page is used only for the following:

☐ CONDITIONED SPACES ☑ UNCONDITIONED SPACES

MANDATORY AND PRESCRIPTIVE INDOOR LIGHTING CONTROL SCHEDULE, PAF CALCULATION, and FIELD INSPECTION CHECKLIST

Lighting Control Schedule			Standards Complying With [1] (✓ all that apply, or enter 'E' if Exempted)							PAF Credit Calculation [2]			✓ if Acceptance Test Required	Field Inspector	
										Watts of Controlled Lighting	PAF	Control Credit (K x L)			
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
Location in Building	Type/ Description of Lighting Control (i.e.: occupancy sensor, automatic time switch, dimmer, automatic daylight, etc…)	# of Units	§130.1(a)	§130.0(b)	§130.1(c)	§130.1(d)	§130.1(e)	§140.6(a)2	§140.6(d)					Pass	Fail
All lighting	Manual Area	6	✔										✔	☐	☐
main floor and mezz	Multi Level	3		✔									✔	☐	☐
main floor and mezz	Occupancy Sensor	10			✔								✔	☐	☐
														☐	☐
														☐	☐
														☐	☐
														☐	☐
Control Credit PAGE TOTAL (Sum of Column M):												0			
IF MULTIPLE PAGES ARE USED, ENTER SUM TOTAL OF Control Credit for all pages HERE (Sum of all Column M):												0			
												Enter Control Credit total into NRCC-LTI-01-E; Page 1.			

1. §130.1(a) = Manual area controls; §130.0(b) = Multi Level; §130.1(c) = Auto Shut-Off; §130.1(d) = Mandatory Daylight; §130.1(e) = Demand Responsive; §140.6(d) = Additional lighting controls installed to earn a PAF; §140.6(d) = Prescriptive Secondary Sidelit Daylight Controls.

2. Check Table 140.6-A for correct Factor. PAFs shall not be traded between conditioned and unconditioned spaces. As a condition to earn a PAF, an Installation Certificate is also required to be filled out, signed, and submitted.

CERTIFICATE OF COMPLIANCE	NRCC-LTI-02-E
Indoor Lighting - Lighting Controls	(Page 3 of 3)
Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name: Weld Fickel	Documentation Author Signature:
Company: Sugarpine Engineering, Inc	Signature Date: 12/13/2016
Address: 12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):
City/State/Zip: Truckee, CA 96161	Phone: 530-214-0859

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
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Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip: ,	Phone:

STATE OF CALIFORNIA

INDOOR LIGHTING POWER ALLOWANCE

CEC-NRCC-LTI-03-E (Revised 05/15) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-03-E
Certificate of Compliance - Indoor Lighting Power Allowance	(Page 1 of 4)

Project Name:	Date Prepared: 12/13/2016

A separate page must be filled out for Conditioned and Unconditioned Spaces. This page is only for:

☐ CONDITIONED spaces ☑ UNCONDITIONED spaces

A. SUMMARY TOTALS OF LIGHTING POWER ALLOWANCES

☐ If using Complete Building Method for compliance, use only the total in column (a) as total allowed building watts.

☐ If using Area Category Method, Tailored Method, or a combination of Area Category and Tailored Method for compliance, use only the total in column (b) as the total allowed building watts

	(a)		(b)
1. Complete Building Method Allowed Watts. Documented in section B of NRCC-LTI-03-E (below on this page)			
2. Area Category Method Allowed Watts. Documented in section C-1 of NRCC-LTI-03-E (below on this page)			3,570
3. Tailored Method Allowed Watts. Documented in section A of NRCC-LTI-04-E			0
TOTAL ALLOWED BUILDING WATTS. Enter number into correct cell on NRCC-LTI-01, Page 2, Row 1			3,570

☐ Check here if building contains both conditioned and unconditioned areas.

B. COMPLETE BUILDING METHOD LIGHTING POWER ALLOWANCE

1	2		3		4
TYPE OF BUILDING (From §140.6 Table 140.6-B)	**WATTS PER** (ft^2)	**X**	**COMPLETE BLDG. AREA**	**=**	**ALLOWED WATTS**
Total Area:					
Total Watts. Enter Total Watts into section A, row 1 (Above on this page)					

C -1 AREA CATEGORY METHOD TOTAL LIGHTING POWER ALLOWANCES (D plus E)	Watts
Total from section C-2 .	3,570
Total from section C-3 .	0
Total Watts. Enter Total Watts into section A, row 2 (Above on this page) .	3,570

STATE OF CALIFORNIA

INDOOR LIGHTING POWER ALLOWANCE

CEC-NRCC-LTI-03-E (Revised 05/15)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-03-E
Certificate of Compliance - Indoor Lighting Power Allowance	(Page 2 of 4)
Project Name:	Date Prepared: 12/13/2016

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C -2 AREA CATEGORY METHOD GENERAL LIGHTING POWER ALLOWANCE

☐ Do not include portable lighting for offices. Portable lighting for offices shall be documented only in section B of NRCC-LTI-01-E.

☐ Separately list lighting for each primary function area as defined in §100.1 of the Standards.

A		B		C		D
AREA CATEGORY (From §140.6 Table 140.6-C)		WATTS				ALLOWED
Location in Building	Primary Function Area per Table 140.6-C	PER (ft^2)	X	AREA (ft^2)	=	WATTS
Vehicle Storage	Industrial Work, High Bay	1.00		3,570		3,570
		TOTALS		3,570		
		Enter sum total Area Category allowed watts into section C-1 of NRCC-LTI-03-E (this compliance form)				3,570
						WATTS

CERTIFICATE OF COMPLIANCE	NRCC-LTI-03-E
Certificate of Compliance - Indoor Lighting Power Allowance	(Page 3 of 4)
Project Name:	Date Prepared: 12/13/2016

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☐ CONDITIONED spaces ☑ UNCONDITIONED spaces

C-3 AREA CATEGORY METHOD ADDITIONAL LIGHTING WATTAGE ALLOWANCE (from Table 140.6-C Footnotes)

A	B	C [2]	D	E	F	G
Primary Function	Sq Ft or linear ft [1]	Additional Watts Allowed	Wattage Allowance (B x C)	Description(s) and Quantity of Special Luminaire Types in each Primary Function Area	Total Design Watts [3]	ALLOWED WATTS Smaller of D or F
				TOTALS – Enter into TOTAL AREA CATEGORY METHOD ADDITIONAL ALLOWANCES – Section C-1 .		0

1. Use linear feet only for additional allowance for white board or chalk board. All other additional Area Category allowances shall use watts per square foot.
2. Additional watts are available only when allowed according to the footnotes on bottom of Table 146-C, which include: Specialized task work; Ornamental lighting; Precision commercial and industrial work; Per linear foot of white board or chalk board; Accent, display and feature lighting; and Videoconferencing Studio lighting..
3. Luminaire classification and wattage shall be determined in accordance with §130.0(c) of the Standards.

STATE OF CALIFORNIA

INDOOR LIGHTING POWER ALLOWANCE

CEC-NRCC-LTI-03-E (Revised 05/15) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-LTI-03-E
Certificate of Compliance - Indoor Lighting Power Allowance	(Page 4 of 4)

Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

1. I certify that this Certificate of Compliance documentation is accurate and complete.

Documentation Author Name: Weld Fickel	Documentation Author Signature:
Company: Sugarpine Engineering, Inc	Signature Date: 12/13/2016
Address: 12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):
City/State/Zip: Truckee, CA 96161	Phone: 530-214-0859

RESPONSIBLE PERSON'S DECLARATION STATEMENT

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Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip: ,	Phone:

CERTIFICATE OF COMPLIANCE	NRCC-LTO-01-E
Outdoor Lighting	(Page 1 of 4)
Project Name:	Date Prepared: 12/13/2016

Project Address: ,	Total Illuminated Hardscape Area 0

General Information

Phase of Construction: ☑ New Construction ☐ Addition ☐ Alteration

Outdoor Lighting Zone (OLZ) ☐ OLZ-1 ☐ OLZ-2 ☑ OLZ-3 ☐ OLZ-4

I have confirmed with the AHJ which OLZ applies to this site. For default lighting zone designations, see Title 24 Part 6, §10-114

LIGHTING COMPLIANCE DOCUMENTS (check box for each document included)

For detailed instructions on the use of this and all Energy Efficiency Standards compliance documents, refer to the Nonresidential Manual published by the California Energy Commission.

☑	NRCC-LTO-01-E	Certificate of Compliance
☑	NRCC-LTO-02-E	Outdoor Lighting Controls Certificate of Compliance
☑	NRCC-LTO-03-E	Outdoor Lighting Power Allowance Certificate of Compliance

Summary of Allowed Outdoor Lighting Power		Watts	
1.	**Sum Total ALLOWED** Outdoor Lighting Wattage from NRCC-LTO-03-E, page 1	=	123
	Complies ONLY if **Installed** ≤ **Allowed**		↕
2.	**Sum Total INSTALLED** Outdoor lighting Wattage from NRCC-LTO-01-E, page 3		123

Declaration of Required Installation Certificates – Declare by checking all Installation Certificates that will be submitted. (Retain copies and verify forms are completed and signed.)

☑ NRCI-LTO-01-E - Must be submitted for all buildings	☐ Field Inspector
☑ NRCI-LTO-02-E - Must be submitted for a lighting control system, or for an Energy Management Control System (EMCS), to be recognized for compliance.	☐ Field Inspector

Declaration of Required Certificates of Acceptance – Declare by checking all of the Certificates of Acceptance that will be submitted. (Retain copies and verify forms are completed and signed.)

☑ NRCA-LTO-02-A - Must be submitted for outdoor lighting controls.	☐ Field Inspector

CERTIFICATE OF COMPLIANCE	NRCC-LTO-01-E
Outdoor Lighting	(Page 2 of 4)
Project Name:	Date Prepared: 12/13/2016

Schedule of luminaires exempt from the outdoor lighting power requirements in §140.7	
Name or Symbol	Description of exempt luminaire in accordance with the exemptions

Schedule of luminaires exempt from the cutoff requirements in §130.2(b)	
Name or Symbol	Description of exempt luminaire in accordance with the exemptions

Schedule of luminaires exempt from the outdoor lighting control requirements in §130.2(c)	
Name or Symbol	Description of exempt luminaire in accordance with the exemptions

CERTIFICATE OF COMPLIANCE	NRCC-LTO-01-E
Outdoor Lighting	(Page 3 of 4)
Project Name:	Date Prepared: 12/13/2016

A. OUTDOOR LIGHTING SCHEDULE and FIELD INSPECTION ENERGY CHECKLIST

Luminaire Schedule		Installed Watts					Location	Cutoff	Field Inspector	
A	B	C	D		E	F	G	H	I	
			How wattage was determined							
Name or Item Tag	Complete Luminaire Description	Watts per Luminaire	CEC Default from NA8	According to §130.0(c)	Number of Luminaires	Total Installed Watts in this area (C x E)	Primary Function area in which these luminaires are installed	BUG Rating	Pass	Fail
L3	L3 Wall pack LED with motion dimming	41.0	☑	☐	3	123	Building Facade		☐	☐
			☐	☐					☐	☐
			☐	☐					☐	☐
			☐	☐					☐	☐
			☐	☐					☐	☐
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			☐	☐					☐	☐
			☐	☐					☐	☐
			☐	☐					☐	☐
INSTALLED WATTS PAGE TOTAL:						123	Enter sum total of all pages (**Sum Total INSTALLED** Outdoor lighting wattage) into NRCC-LTO-01-E; Page 1		123	

CERTIFICATE OF COMPLIANCE	NRCC-LTO-01-E
Outdoor Lighting	(Page 4 of 4)
Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT

1. I certify that this Certificate of Compliance documentation is accurate and complete.

Documentation Author Name:	Weld Fickel	Documentation Author Signature:	
Company:	Sugarpine Engineering, Inc	Signature Date:	12/13/2016
Address:	12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):	
City/State/Zip:	Truckee, CA 96161	Phone:	530-214-0859

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.
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Responsible Designer Name:		Responsible Designer Signature:	
Company :		Date Signed:	
Address:		License:	
City/State/Zip:	,	Phone:	

CERTIFICATE OF COMPLIANCE	NRCC-LTO-02-E
Outdoor Lighting Controls	(Page 1 of 3)
Project Name:	Date Prepared: 12/13/2016

The NRCC-LTO-02-E shall be used to document all mandatory outdoor lighting controls that are applicable to the project.

Mandatory Outdoor Lighting Control Declaration Statements

Check all that apply:

- ☑ Lighting shall be controlled by self-contained lighting control devices which are certified to the Energy Commission according to the Title 20 Appliance Efficiency Regulations in accordance with §110.9(a).
- ☐ Lighting shall be controlled by a lighting control system or energy management control system in accordance with §110.9. An Installation Certificate shall be submitted in accordance with §130.4(b).
- ☑ All lighting controls and equipment shall comply with the applicable requirements in §110.9 and shall be installed in accordance with the manufacturer's instructions in accordance with §130.1
- ☐ Part-Night Outdoor Lighting Controls, as defined in Section 100.1(b), shall meet the requirements in Section 110.9(b)5
- ☐ All outdoor incandescent luminaires rated over 100 watts, determined in accordance with Section 130.0(c), shall be controlled by a motion sensor.
- ☑ All outdoor luminaires rated for use with lamps greater than 150 lamp watts, determined in accordance with Section 130.0(c), shall comply with Backlight, Uplight, and Glare (collectively referred to as "BUG") in accordance with Section 130.2(b)
- ☑ All installed outdoor lighting shall be controlled by a photocontrol or outdoor astronomical time-switch control in accordance with Section 130.2(c)1
- ☑ All installed outdoor lighting shall be circuited and independently controlled from other electrical loads by an automatic scheduling control in accordance with Section 130.2(c)2
- ☑ All installed outdoor lighting, where the bottom of the luminaire is mounted 24 feet or less above the ground, shall be controlled with automatic lighting controls in accordance with Section 130.2(c)3
- ☐ For Outdoor Sales Frontage, Outdoor Sales Lots, and Outdoor Sales Canopies lighting, an automatic lighting control in accordance with Section 130.2(c)4
- ☐ For Building Facade, Ornamental Hardscape and Outdoor Dining lighting, an automatic lighting control in accordance with Section 130.2(c)5
- ☑ Before an occupancy permit is granted for a newly constructed building or area, or a new lighting system serving a building, area, or site is operated for normal use, indoor lighting controls serving the building, area, or site shall be certified as meeting the Acceptance Requirements for Code Compliance in accordance with §130.4.(a). Outdoor lighting controls shall comply with the applicable requirements of Section 130.2(c) and Reference Nonresidential Appendix NA7.8

MANDATORY OUTDOOR LIGHTING CONTROL SCHEDULE and FIELD INSPECTION CHECKLIST

Outdoor Lighting Control Schedule			Standards Complying With (✓ all that apply, or enter 'E' if Exempted)						✓ if Acceptance Test Required	Field Inspector	
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**N**	**O**	
Location and Application of Luminaires being controlled	Type/ Description of Lighting Control (i.e. motion sensor, photocontrol, outdoor astronomical time-switch control, centralized time-based zone lighting control)	# of Units	§130.2(a)	§130.2(c)1	§130.2(c)2	§130.2(c)3	§130.2(c)4	§130.2(c)5		Pass	Fail
all outdoor lights	Photocontrol	3		✓					✓	☐	☐
all outdoor lights	Motion Sensor	3				✓			✓	☐	☐
										☐	☐
										☐	☐
										☐	☐
										☐	☐
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										☐	☐
										☐	☐

CERTIFICATE OF COMPLIANCE	NRCC-LTO-02-E
Outdoor Lighting Controls	(Page 3 of 3)
Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name: Weld Fickel	Documentation Author Signature:
Company: Sugarpine Engineering, Inc	Signature Date: 12/13/2016
Address: 12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):
City/State/Zip: Truckee, CA 96161	Phone: 530-214-0859

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Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip: ,	Phone:

CERTIFICATE OF COMPLIANCE	NRCC-LTO-03-E
Outdoor Lighting Power Allowances	(Page 1 of 4)
Project Name:	Date Prepared: 12/13/2016

A. OUTDOOR LIGHTING POWER ALLOWANCE SUMMARY

1. General Hardscape Lighting Power Allowance (Site Total from Section B of NRCC-LTO-03-E)								1.	0
2. Additional Specific "use it or lose it" Lighting Power Allowances listed in each of these cells shall be identical to total allowed watts determined in Section C-1 to C-4 of NRCC-LTO-03-E.									
PER APPLICATION from Section C-1		PER UNIT LENGTH (SALES FRONTAGE) from Section C-2		PER HARDSCAPE AREA (ORNAMENTAL LIGHTING) from Section C-3		PER SPECIFIC AREA from Section C-4.			
0	+	0	+	0	+	123	=	2.	123
3. **Sum Total ALLOWED** Outdoor Lighting Wattage (add rows 1 and 2)								3.	123

B. GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE FROM TABLE 140.7-A

Area Wattage Allowance (AWA)				Linear Wattage Allowance (LWA)			Initial Wattage Allowance (IWA)	Total General Hardscape Lighting Allowance
A	B	C	D	E	F	G	H	I
Name of area	Illuminated Hardscape Area	AWA Per Square Foot	AWA (B x C)	Perimeter Length of General Hardscape	LPA per Linear Foot	LWA (E x F)	IWA (Watts)	D + G + H
							TOTAL	0

C. ADDITIONAL "USE IT OR LOSE IT" OUTDOOR LIGHTING POWER ALLOWANCES FOR SPECIFIC APPLICATIONS

☐ The additional specific outdoor lighting power allowance shall be the smaller of the allowed lighting power or the actual lighting power used.

☐ Use Outdoor Lighting Zone (OLZ) that is documented on page 1 of NRCC-LTO-01-E to calculate the specific wattage allowances.

C-1. WATTAGE ALLOWANCE PER APPLICATION – Table 140.7-B

☐ Available only for qualifying locations, which include Building Entrances or Exits; Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities; Drive Up Windows; Vehicle Service Station Uncovered Fuel Dispenser

☐ If more than one luminaire type is used per location, use multiple rows for that location

A	B	C	D	E	F	G	H	I	J
	ALLOTTED WATTS			DESIGN WATTS					
Name of Location for which allowance is claimed	Number of qualifying locations	Wattage Allowance per qualifying location	Allotted Watts (B x C)	Luminaire Code or Symbol	Luminaire Description	Luminaire Quantity	Watts per luminaire	Design Watts (G x H)	Allowed Watts (smaller of D or I)
								Sum total allowance per application on this site:	0

C-2. WATTAGE ALLOWANCE PER UNIT LENGTH (Sales Frontage) from Table 140.7-B

☐ If more than one luminaire type is used per location, use multiple rows for that location

A	B	C	D	E	F	G	H	I	J
	ALLOTTED WATTS			DESIGN WATTS					
Name of Location for which allowance is claimed	Linear feet of Sales Frontage	Wattage Allowance per linear foot	Allotted Watts (B x C)	Luminaire Code or Symbol	Luminaire Description	Luminaire Quantity	Watts per luminaire	Design Watts (G x H)	Allowed Watts (smaller of D or I)
								Sum total allowance for sales frontage on the site:.	0

C-3. WATTAGE ALLOWANCE PER SQUARE FOOT OF HARDSCAPE AREA (Ornamental Lighting) – Table 140.7-B

☐ Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130.0(c), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.

☐ If more than one luminaire type is used per location, use multiple rows for that location

A	B	C	D	E	F	G	H	I	J
	ALLOTTED WATTS			DESIGN WATTS					
Name of area for which ornamental allowance is claimed	Square feet of Hardscape	Wattage Allowance per square foot	Allotted Watts (B x C)	Luminaire Code or Symbol	Luminaire Description	Luminaire Quantity	Watts per luminaire	Design Watts (G x H)	Allowed Watts (smaller of D or I)
								Sum total allowance for ornamental lighting on the site:.	0

C-4. WATTAGE ALLOWANCE PER SQUARE FOOT OF SPECIFIC AREA - Table 140.7-B

☐ Allowances for Building Facades; Outdoor Sales Lots; Vehicle Service Station Hardscape; Vehicle Service Station Canopies; Sales Canopies; Non-sales Canopies; Guard Stations; Student Pick-up/Drop-off zone: Outdoor Dining; Special Security Lighting for Retail Parking and Pedestrian Hardscape.

☐ If more than one luminaire type is used per location, use multiple rows for that location

A	B	C	D	E	F	G	H	I	J
	ALLOTTED WATTS			DESIGN WATTS					
Name of Location for which allowance is claimed	Illuminated Area of Application	Wattage Allowance per square foot	Allotted Watts (B x C)	Luminaire Code or Symbol	Luminaire Description	Luminaire Quantity	Watts per luminaire	Design Watts (G x H)	Allowed Watts (smaller of D or I)
Wall packs	1,704	0.350	596	L3	L3 Wall pack LED with motio	3	41.0	123	123
								Sum total allowance for specific area on the site:	123

CERTIFICATE OF COMPLIANCE	NRCC-LTO-03-E
Outdoor Lighting Power Allowances	(Page 4 of 4)
Project Name:	Date Prepared: 12/13/2016

DOCUMENTATION AUTHOR'S DECLARATION STATEMENT	
1. I certify that this Certificate of Compliance documentation is accurate and complete.	
Documentation Author Name: Weld Fickel	Documentation Author Signature: 
Company: Sugarpine Engineering, Inc	Signature Date: 12/13/2016
Address: 12710 Northwoods Blvd, #3	CEA Certification Identification (if applicable):
City/State/Zip: Truckee, CA 96161	Phone: 530-214-0859

RESPONSIBLE PERSON'S DECLARATION STATEMENT

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.

Responsible Designer Name:	Responsible Designer Signature:
Company :	Date Signed:
Address:	License:
City/State/Zip: ,	Phone:

GEOTECHNICAL ENGINEERING REPORT
for
Truckee Tahoe Airport Maintenance Building Addition
Truckee, California

Prepared for:
Acumen Engineering Company
P.O. Box 3497
Truckee, California 96160

Prepared by:
Holdrege & Kull
10775 Pioneer Trail, Suite 213
Truckee, California 96161

Project No. 41377A-02
February 17, 2016

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 41377A-02
February 17, 2016

Acumen Engineering Company
P.O. Box 3497
Truckee, California 96160

Attention: Bill Quesnel, P.E.

Reference: ***Truckee Tahoe Airport Maintenance Building Addition***
12110 Chandelle Way
Truckee, California

Subject: ***Geotechnical Engineering Report***

This report presents the results of our geotechnical engineering investigation for the proposed Truckee Tahoe Airport Maintenance Building Addition located at 12110 Chandelle Way in Truckee, California. The site contains an existing maintenance building and asphalt paved parking. The proposed project will involve constructing an approximately 2,400 square foot pre-fabricated addition to the northeast side of the existing structure. We previously prepared a geotechnical engineering and building foundation review report for the Truckee Tahoe Airport District Facilities Maintenance Master Plan, dated July 9, 2013. Our previous report included an evaluation of the subject Maintenance Building.

Soil conditions encountered in our field investigation generally consisted of medium dense granular soil types of low plasticity that should provide suitable foundation support for the proposed structures on conventional shallow spread foundations. No highly plastic, compressible, or potentially expansive soil was encountered.

The site is suitable for the proposed development using conventional earthwork grading and foundation construction techniques. Specific recommendations regarding the geotechnical aspects of project design and construction are presented in the following report.

The findings presented in this report are based on our subsurface exploration, laboratory test results, and experience in the project area. We recommend retaining our

firm to provide construction monitoring services during earthwork and foundation excavation to observe subsurface conditions encountered with respect to our recommendations provided in this report. As plans develop, we should be consulted concerning the need for additional services.

Please contact us if you have any questions regarding this report or if we can be of additional service.

Sincerely,

Holdrege & Kull

Prepared By:

PROFESSIONAL GEOLOGIST
PAMELA J. RAYNAK
No. 7180
STATE OF CALIFORNIA
2-17-16

Pamela J. Raynak, P.G.
Senior Geologist

Reviewed By:

REGISTERED PROFESSIONAL ENGINEER
JOHN K. HUDSON
No. C 050923
2-17-16
CIVIL
STATE OF CALIFORNIA

John K. Hudson, P.E., C.E.G.
Principal

Copies: 3 to Bill Quesnel, Acumen Engineering Company

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FIGURES

Figure 1 – Site Vicinity Map
Figure 2 – Test Pit Location Plan

APPENDICES

Appendix A Proposal
Appendix B Important Information About Your Geotechnical Engineering Report
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Appendix D Laboratory Test Results

1. INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed Truckee Tahoe Airport Maintenance Building Addition located at 12110 Chandelle Way in Truckee, California. We performed our investigation in general accordance with our November 17, 2015 proposal for the project. A copy of the proposal is included as Appendix A of this report. For your review, Appendix B contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report.* This document summarizes the general limitations, responsibilities, and use of geotechnical engineering reports. We previous prepared a geotechnical engineering and building foundation review report for the Truckee Tahoe Airport District (TTAD) Facilities Maintenance Master Plan, dated July 9, 2013. Our previous report included an evaluation of the on-site building.

1.1 Purpose

The purpose of our investigation was to explore and evaluate the subsurface conditions at the project site, and to provide our geotechnical engineering recommendations for project design and construction.

Our findings are based on our subsurface exploration, laboratory test results, and our experience in the project area. We recommend retaining our firm to provide construction monitoring services during earthwork and foundation excavation to observe subsurface conditions encountered with respect to our recommendations.

1.2 Scope of Services

To prepare this report we performed the following scope of services:

- We performed a site reconnaissance, literature review, and subsurface exploration involving backhoe-excavated test pits.
- We logged the subsurface conditions encountered and collected bulk soil samples for classification and laboratory testing.
- We performed laboratory tests on selected soil samples obtained during our subsurface investigation to evaluate material properties.
- Based on our subsurface exploration and the results of our laboratory testing, we performed engineering analyses to develop geotechnical engineering recommendations for project design and construction.

1.3 Site Description

The project site is located at the southeast intersection of Chandelle Way and Aviation Way in Truckee, California. The approximate location of the site is shown on Figure 1, Site Vicinity Map. The proposed project will involve constructing an approximately 2,400 square-foot pre-fabricated addition to the existing maintenance building at the site. A plan view of the proposed project is shown on Figure 2, Test Pit Location Plan.

The project site is bounded by Chandelle Way to the northeast, undeveloped land to the southeast and southwest, and Aviation Way to the northwest. An existing approximately 9,300 square-foot building is located on the site that is used for general maintenance and operations purposes by the Truckee Tahoe Airport District (TTAD). The on-site building is a one-story, pre-fabricated, metal building with a partial mezzanine and slab-on-grade floors. We understand the existing structure was built in 1998. Based on our visual observations of the existing on-site structure, no obvious signs of significant foundation settlement were observed. An existing earthen catchment basin is located near the northeast corner of the site. Due to the existing development and paved surfaces, the site is generally devoid of vegetation.

According to the 1992 edition of the Truckee, California 7.5-minute quadrangle map published by the United States Geological Survey (USGS); the subject site comprises a portion of Section 13, Township 17 North, and Range 16 East. The site lies at an elevation of approximately 5,900 feet above mean sea level (MSL). Surface water drainage consists of overland flow and flows towards an earthen catchment basin in the northeast corner of the site. The site generally slopes very gently down from southwest to northeast.

1.4 Proposed Improvements

Information about the proposed project was obtained from our site visits, conversations with Bill Quesnel of Acumen Engineering Company (AEC), and a preliminary site plan prepared by AEC, dated November 9, 2015. As currently proposed, the project will involve constructing an approximately 2,400 square foot, single-story, pre-fabricated addition to the northeast side of the existing structure. The addition will be steel-frame construction with a mezzanine and slab-on-grade floors. Estimated vertical structural loads are not expected to exceed about 200 kips at isolated columns and 6 kips per linear foot along continuous wall foundations for long-term loading. The existing asphalt paved area and earthen catchment basin northeast of the building will be used to accommodate the new addition. We anticipate average cut and fill depths will be about 1 to 2 feet and will not exceed about 3 feet. Appurtenant construction will include new underground utilities and relocating the existing catchment basin to the east. No detailed grading plans were available for review.

2. LITERATURE REVIEW

We reviewed available geologic and soil literature in our files to evaluate geologic and anticipated subsurface conditions at the project site.

2.1 Site Geology

We reviewed the *Geologic Map of the Lake Tahoe Basin, California and Nevada,* by George J. Saucedo, California Geological Survey, 2005. In addition we reviewed a geologic map and report titled *Geologic Map of the North Lake Tahoe-Donner Pass Region, Northern Sierra Nevada, California*, by Arthur Gibbs Sylvester et al., California Geological Survey, 2012. The geologic maps indicate that the site is underlain by Quaternary aged glacial outwash deposits comprised of silt, sand, gravel, cobbles, and boulders.

2.2 Regional Faulting

The project is located in a potentially active seismic area. To evaluate the location of mapped faults relative to the project site, we reviewed the following maps:

- *Fault Activity Map of California;* by Charles W. Jennings and William A. Bryant, California Geological Survey, 2010.

- *Geologic Map of the Chico Quadrangle, California,* by G.J. Saucedo and D.L. Wagner, California Division of Mines and Geology, 1992.

The potential risk of fault rupture is based on the concept of recency and recurrence. The more recently a particular fault has ruptured, the more likely it will rupture again. The California State Mining and Geology Board define an “active fault” as one that has had surface displacement within the past 11,000 years (Holocene). Potentially active faults are defined as those that have ruptured between 11,000 and 1.6 million years before the present (Quaternary). Faults are generally considered inactive if there is no evidence of displacement during the Quaternary.

The referenced geologic maps show several active and potentially active faults located near the project site, including the Dog Valley Fault (active, approximately 6 miles northwest), a group of unnamed faults southeast of Truckee (active and potentially active, approximately 1.5 and 2.5 miles southwest), the Polaris Fault (active, approximately 2 miles northeast), the West Tahoe Fault (active, approximately 16 miles south), and the North Tahoe Fault (active, approximately 11.5 miles southeast of the

site). Earthquakes associated with these faults may cause strong ground shaking at the project site.

The potential hazard associated with earthquake faults involves surface rupture and strong ground motion. No faults are mapped as crossing or trending towards the site; therefore, the potential for surface rupture at the site is considered low. Earthquakes centered on regional faults in the area, such as the West Tahoe Fault, would likely result in higher ground motion at the site than earthquakes centered on smaller faults that are mapped closer to the site.

2.3 Secondary Seismic Hazards

Secondary seismic hazards include liquefaction, lateral spreading, and seismically induced slope instability and rock fall. Liquefaction is a phenomenon where loose, saturated, granular soil deposits lose a significant portion of their shear strength due to excess pore water pressure buildup. Cyclic loading, such as an earthquake, typically causes the increase in pore water pressure and subsequent liquefaction. Based on the results of our subsurface investigation, and experience in the site area, near-surface soil at the site consists of loose to medium dense silty sand with gravel and cobbles. This soil profile will have a low potential for liquefaction.

Lateral spreading is the lateral movement of soil resulting from liquefaction of subadjacent materials. Since we anticipate that there is a low potential for liquefaction of soil at the site, the potential for lateral spreading to occur is also considered low.

Slope instability includes landslides, debris flows, and rock fall. No landslides, debris flows or rock fall hazards were observed in the site area. Due to the gentle topography of the site and general surrounding area the potential for slope instability and seismically induced rock fall is considered low.

3. SUBSURFACE EXPLORATION

We performed our subsurface exploration to characterize typical subsurface conditions at the site.

3.1 Field Exploration

The subsurface conditions at the site were investigated on November 20, 2015, by excavating two exploratory test pits to depths ranging from 6 to 9 feet below the ground surface (bgs). The test pits were excavated with a Caterpillar 416 rubber tire backhoe

equipped with a 12-inch ditch bucket. Test pit locations were selected based on locations of proposed improvements and site access.

A geologist from our firm logged the soil conditions exposed in the test pits, visually classified soil, and collected bulk soil samples for laboratory testing. Soil samples were packaged and sealed in the field to reduce moisture loss and were returned to our laboratory for testing. Upon completion, the test pits were backfilled with the excavated soil. The approximate locations of our test pits are shown on Figure 2, Test Pit Location Plan.

3.2 Subsurface Soil Conditions

Our test pits were located within the existing earthen catchment basin at the site. Near-surface soil encountered in our test pits consisted of 2 to 3 inches of loose silty sand (SM) containing organic material (topsoil). Underlying the silty sand topsoil, our test pits encountered medium dense, weakly to moderately cemented, silty sand (SM) with varying amounts of gravel and cobbles to the maximum depth explored of 9 feet below the ground surface (bgs). Test Pit TP-1 met essential refusal on cobbles at a depth of approximately 6 feet bgs. More detailed descriptions of the subsurface conditions observed are presented in our Test Pit Logs in Appendix C.

We previous prepared a geotechnical engineering and building foundation review report for the TTAD Facilities Maintenance Master Plan, dated July 9, 2013. As part of our previous study, we reviewed the following reports pertaining to the site:

- *Geotechnical Investigation, Reconstruction of the Main & South Airport Aprons, Access Road and South Apron Extension, Truckee/Tahoe Airport, Truckee, California*, dated November 18, 1998, prepared by Agra Earth & Environmental, Inc. (Agra 1998a).

- *Geotechnical Investigation, Pavement Reconstruction at Hangar Row A, Truckee/Tahoe Airport, Truckee, California*, dated February 14, 2001, prepared by Agra Earth & Environmental, Inc. (Agra 2003).

- *Geotechnical Investigation Report, Proposed Maintenance Building, Truckee Tahoe Airport, Truckee, California*, dated October 17, 1991, prepared by Kleinfelder (Kleinfelder 1991).

According to the reports listed above, the upper approximately 1.5 feet of soil at the site consisted of soft sandy silt that was underlain by loose to dense granular soil types (silty sand, silty gravel, and clayey sand) to a depth of approximately 11.5 feet bgs. We suspect that the soft sandy silt soil was removed during construction of the existing

maintenance building in 1998, and was likely replaced with compacted, structural fill. Groundwater was not encountered at the site during previous investigations.

3.3 Groundwater Conditions

We did not observe groundwater during our subsurface exploration. However, fluctuations in soil moisture content and groundwater levels should be anticipated depending on precipitation, irrigation, runoff conditions and other factors. Based on our experience in the project area, seasonal saturation of near-surface soil should be anticipated, especially during and immediately after seasonal snowmelt.

Moderately cemented soil was encountered in our test pits at depths ranging from 2.5 to 3 feet bgs. Depending on final site grades, rainfall, irrigation practices, and other factors, perched groundwater will likely seasonally develop above onsite cemented soil. Perched groundwater may cause moisture intrusion into through concrete slab-on-grade floors, degradation of asphalt concrete pavements, and other adverse conditions. Mitigation measures such as gravel underdrains, elevated building pads, trench drains, water barriers, or other methods may be required to intercept shallow groundwater or reduce potential adverse effects on project features. We recommend the project civil engineer in conjunction with the project geotechnical engineer review the subsurface information available within this report and revealed during site preparation in order to develop appropriate measures consistent with design considerations beyond the current scope of this study.

4. LABORATORY TESTING

We performed laboratory tests on bulk soil samples collected from our exploratory test pits to help evaluate their engineering properties. The following laboratory tests were performed:

- Atterberg Limits/Plasticity (ASTM Test Method D4318)
- Sieve Analysis (ASTM D422)
- Expansion Index (ASTM D4829)

Sieve analysis and Atterberg Limits data typically resulted in a USCS classification of Silty Sand with Gravel (SM). Expansion testing of a soil sample collected from Test Pit TP-1 at a depth of 1.5 feet bgs, indicated that the soil has a very low potential for expansion. More specific soil classification and laboratory test data is included in Appendix D. USCS classification and Atterberg indices are summarized below.

Table 4.1 – Summary of Laboratory Test Results				
Test Pit Number	Depth (feet)	USCS Classification	Liquid Limit	Plastic Limit
TP-1	1.5	Silty Sand with Gravel (SM)	Non-Plastic	Non-Plastic
TP-1	3.5	Silty Sand with Gravel (SM)	--	--

5. CONCLUSIONS

The following conclusions are based on our field observations, laboratory test results, and our experience in the project area.

1. Soil conditions encountered in our field investigation generally consisted of loose to medium dense granular soil types of low plasticity that should provide suitable foundation support for the proposed structures on conventional shallow spread foundations. No highly plastic, compressible, or potentially expansive soil was encountered.

2. The Caterpillar 416 backhoe used for our field exploration met essential refusal on cobbles in Test Pit TP-1 at a depth of about 6 feet bgs, largely due to the small bucket on the equipment. We anticipate that conventional equipment should not have difficulty excavating to depths of 10 feet at the site. A significant amount of cobbles should be anticipated in on site excavations. With the exception of the organic surface soil, site soil is generally suitable for reuse as structural fill; however, processing to remove oversized material will likely be necessary.

3. Groundwater was not encountered during our subsurface exploration to the maximum depth explored. However, depending on final site grades, rainfall, and/or irrigation practices, perched groundwater could develop above onsite cemented soil and cause moisture intrusion through concrete slabs-on-grade, degradation of asphalt concrete pavements, and other adverse conditions. Consequently, positive surface and near-surface water drainage will be important across the site to reduce the potential for near-surface water causing adverse conditions. We have provided recommendations to reduce the potential for these adverse effects in the “Recommendations” section of this report.

6. RECOMMENDATIONS

The following geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our field observations, the results of our laboratory tests, engineering analysis, and our experience in the project area.

6.1 Grading

The following sections present our recommendations for site clearing and grubbing, preparation for and placement of fill material, temporary excavation and cut/fill slope grading, utility trench construction, construction dewatering, surface water drainage, plan review, and construction monitoring.

6.1.1 Clearing and Grubbing

Areas proposed for fill placement, road and driveway construction, and building areas should be cleared and grubbed of vegetation and other deleterious materials. Existing vegetation, organic topsoil, and any debris should be stripped and hauled offsite or stockpiled outside the construction limits. Based on our subsurface exploration and due to the developed nature of the site, we expect that stripping will be minimal with the exception of the catchment basin, where the average depth of stripping may be on the order of 3 inches. Organic surface soil may be stockpiled for future use in landscape areas, but is not suitable for use as structural fill. We anticipate that the actual depth of stripping will vary across the site.

Man-made debris and backfill soil in our exploratory test pits or any other onsite excavations should be overexcavated to underlying, competent material and replaced with compacted structural fill. Grubbing may be required where concentrations of organic soil or tree roots are encountered during site grading.

All existing fill should be removed in areas that will support foundation elements, earth retention structures, and concrete slabs-on-grade. Based on our visual observations, loose existing fill is likely present on the slopes surrounding the catchment basin and we suspect that existing fill is located beneath the pavement section between the building and catchment basin. The existing fill should either be replaced with compacted structural fill or improvements may be founded directly on properly prepared underlying native granular soil. The existing fill material will be suitable for re-use as engineered fill material provided any debris exceeding 8 inches maximum dimension and all organic or deleterious material are removed and disposed off-site. Preparation of the subgrade exposed by overexcavation and requirements for engineered fill should be in accordance with recommendations provided below.

All rocks greater than 8 inches in greatest dimension (oversized rock) should be removed from the top 12 inches of soil, if encountered. Oversized rock may be used in landscape areas, rock faced slopes, or removed from the site. Oversized rock should not be placed in fill without prior approval by the project geotechnical engineer.

6.1.2 Preparation for Fill Placement

Where fill placement is planned, the near-surface soil should be scarified to a depth of about 12 inches below existing ground surface or to competent material and then uniformly moisture conditioned to within 2 percent of the ASTM D1557 optimum moisture content. Areas to receive fill should be compacted with appropriate compaction equipment to at least 90 percent of the maximum dry density per ASTM D1557, and proof rolled with a loaded, tandem-axle truck under the observation of a representative of Holdrege & Kull. Any areas that exhibit pumping or rutting should be overexcavated and replaced with compacted fill placed according to the recommendations below.

6.1.3 Fill Placement

Material used for fill construction should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. Engineered fill should consist of granular material, nearly free of organic debris, with liquid limit of less than 40, a plasticity index less than 15, 100 percent passing the 8-inch sieve, and less than 30 percent passing the No. 200 sieve. In general, near-surface, on-site soil types similar to those encountered in our test pits contain less than 30 percent passing the No. 200 sieve and may be used as fill provided all oversized material is removed prior to placement and compaction. Based on our previous experience in the area, site soil may be above optimum moisture content even in late summer and may require air drying or additional compaction effort may be necessary to reach the specified compaction. Moisture content, dry density, and relative compaction of fill should be evaluated by our firm at regular intervals during fill placement. Rock used in fill should be broken into fragments no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be stockpiled for offhaul, later use in rock faced slopes, or placement in landscape areas.

Imported fill material should be predominantly granular, non-expansive, and free of deleterious or organic material. Import material that is proposed for use onsite should be submitted to Holdrege & Kull for approval and laboratory analysis at least 72 hours prior to import.

If site grading is performed during periods of wet weather, near-surface site soil may be significantly above optimum moisture content. These conditions could hamper

equipment maneuverability and efforts to compact fill materials to the recommended compaction criteria. Fill material may require drying to facilitate placement and compaction, particularly during or following the wet season or spring snowmelt. Suitable compaction results may be difficult to obtain without processing the soil (e.g., discing during favorable weather, covering stockpiles during periods of precipitation, etc.).

Fill should be uniformly moisture conditioned to within 2 percent of optimum moisture content and placed in maximum 8-inch thick, loose lifts (layers) prior to compacting. Fill should be compacted to at least of 90 percent of the maximum dry density per ASTM D1557. The upper 8 inches of fill in paved areas should be compacted to at least 95 percent of the maximum dry density per ASTM D1557. Moisture content, dry density, and relative compaction of fill should be evaluated by our firm at regular intervals during fill placement. The earthwork contractor should assist our representative by preparing test pads with the onsite earth moving equipment.

Fill material with more than 30 percent rock larger than ¾-inch is not testable using conventional compaction testing equipment. We recommend that a procedural approach, or method specification, be used for quality assurance during rock fill placement rather than a specified relative compaction. The procedural requirements will depend on the equipment used, as well as the nature of the fill material, and will need to be determined by the geotechnical engineer on site. Based on our experience in the area, we anticipate that the procedural specification will require a minimum of six passes with a Cat 563 or similar, self-propelled vibratory compactor to compact a maximum 8-inch thick loose lift. Processing or screening of the fill may be required to remove rocks larger than 8-inches in maximum dimension. Continuous observation by a representative of Holdrege & Kull will be required during fill placement to confirm that procedural specifications have been met.

6.1.4 Cut/Fill Slope Grading

Permanent cut and fill slopes at the subject site should be stable at inclinations up to 2H:1V; however, we recommend re-vegetating or armoring all cut/fill slopes to reduce the potential for erosion. Steeper slopes may be possible at the site provided slopes are protected from excessive erosion using rock slope protection or similar slope reinforcement. Slopes steeper than 2H:1V should be evaluated on a case by case basis.

Fill should be placed in horizontal lifts to the lines and grades shown on the project plans. Slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.

Equipment width keyways and benches should be provided where fill is placed on side-slopes with gradients steeper than 5H:1V. Benching must extend through loose surface soil into suitable material, and be performed at intervals such that no loose soil is left beneath the fill. Holdrege & Kull should observe keyways and benches prior to fill placement.

The upper two to five feet of cut slopes should be rounded into the existing terrain above the slope to remove loose material and produce a contoured transition from cut face to natural ground. Scaling to remove unstable cobbles and boulders may be necessary. Fill slopes should be compacted as recommended for the placement of engineered fill. The upper 4 to 8 inches may be scarified to help promote revegetation.

6.1.5 Temporary Unconfined Excavations

Based on our understanding of the proposed project, temporary unconfined excavations will likely not be necessary; however, the following criteria may be used for construction of temporary cut slopes adjacent to the proposed structure.

Temporary Slope Inclination (Horizontal to Vertical)	Maximum Height (Feet Below Ground Surface)
Near Vertical	3 - 5
0.5:1	0 – 3

These temporary requirements may require modifications in the field after construction or where loose soil, groundwater seepage, or existing fill is encountered. The slope should be scaled of loose cobbles and boulders. Higher slopes should be covered with strong wire or fabric, firmly secured to prevent roll down of cobbles or other deleterious materials. The contractor is responsible for the safety of workers and should strictly observe federal and local OSHA requirements for excavation shoring and safety. Some raveling of temporary cut slopes should be anticipated. During wet weather, surface water runoff should be prevented from entering excavations. To reduce the likelihood of sloughing or failure, temporary cut slopes must not remain over the winter.

6.1.6 Underground Utility Trenches

We anticipate that the contractor will be able to excavate underground utility trenches using conventional earthmoving equipment across the majority of the site. An excavator with a “thumb” attachment may increase ease of boulder removal at the site, if encountered.

We expect that some caving and sloughing of utility trench sidewalls will occur. The California Occupational Safety and Health Administration (OSHA) requires all utility trenches deeper than 5 feet bgs be shored with bracing equipment or sloped back prior to entry.

Shallow subsurface seepage may be encountered in trench excavations, particularly if utility trenches are excavated during the spring or early summer. The earthwork contractor may need to employ dewatering methods as discussed in the *Construction Dewatering* section below to excavate, place and compact trench backfill materials.

Soil used as trench backfill should be non-expansive and should not contain rocks greater than 4 inches in maximum dimension. Trench backfill should consist of uniformly moisture conditioned soil and be placed in maximum 8-inch thick loose lifts prior to compacting. Unless otherwise specified by the applicable local utility district, pipe bedding and trench backfill should be compacted to at least 90 percent of the maximum dry density per ASTM D1557. Trench backfill placed within 8 inches of subgrade building and driveway areas should be compacted to a minimum relative compaction of 95 percent of the maximum dry density per ASTM D1557. The moisture content, density and relative compaction of fill should be tested by Holdrege & Kull at regular intervals during fill placement.

6.1.7 Construction Dewatering

During our subsurface exploration, we did not encounter groundwater seepage in our exploratory test pits. If grading is performed during or immediately following the wet season or spring snowmelt, seepage may be encountered during grading. We should observe those conditions and provide site specific subsurface drainage recommendations. The following recommendations are preliminary and are not based on a groundwater flow analysis.

We anticipate that dewatering of excavations can be performed by gravity or by constructing sumps to depths below the excavation and removing water with pumps. To maintain stability of the excavation when placing and compacting the trench backfill, groundwater levels should be drawn down a minimum of 2 feet below the lowest point of the excavation.

If seepage is encountered during trench excavation, it may be necessary to remove underlying saturated soil and replace it with free draining, open-graded crushed rock. Soil backfill may be placed after backfilling with drain rock to an elevation higher than encountered groundwater.

6.1.8 Surface Water Drainage

Based on our observations and past experience with geotechnical investigations in the project vicinity, there is a relatively high potential for seasonal saturation of near-surface soil and groundwater seepage into the foundation areas. In addition, near-surface cemented soil was encountered in our test pits at depth of about 2.5 to 3 feet below existing site grade. Depending on final site grades, rainfall, irrigation practices, and other factors beyond the scope of this study, perched groundwater will likely seasonally develop above onsite cemented soil. Near-surface groundwater may migrate through concrete floor slabs, degrade asphalt concrete pavements, increase frost heave, and contribute to other adverse conditions.

Final elevations at the site should be planned so that drainage is directed away from all foundations and pavements. Ponding of surface water should not be allowed near pavements or structures. Paved areas should be sloped away from structures a minimum of 2 percent and drainage gradients should be maintained to carry all surface water to a properly designed infiltration or detention basin.

Drains should be constructed on the upslope side of exterior foundations and should be placed along continuous interior wall foundations and in all crawl space areas. Drains should extend to a properly designed infiltration gallery. Recommended subsurface drain locations can be provided at the time of construction and when foundation elevations are known. Due to the gentle topography of the site, elevations of foundations should be carefully planned so that it is possible to install gravity-fed drains that daylight a minimum of 10 feet from structures.

All foundation and slab-on-grade concrete should have a water to cement ratio of 0.45 or less. Underslab or blanket drains should be considered in floor pavement areas to reduce moisture transmission through the floor and help maintain subgrade support.

If open-graded gravel or other permeable material is used for underground utilities, the trench should slope away from the structure or the potential flow path should be plugged with a less permeable material at the exterior of the foundation. All utility pipes should have sealed joints.

Roof drip-lines should be protected from erosion with a gravel layer and riprap. Roof downspouts should be directed to a closed collector pipe that discharges flow to positive drainage. Backfill soil placed adjacent to building foundations should be placed and compacted such that water is not allowed to pond or infiltrate. Backfill should be free of deleterious material and placed and compacted in accordance with the above earthwork recommendations.

6.1.9 Plan Review and Construction Monitoring

Construction monitoring includes review of plans and specifications and observation of onsite activities during construction as described below. We should review final grading and foundation plans prior to construction to evaluate whether our recommendations have been implemented and to provide additional and/or modified recommendations, if necessary. We also recommend that our firm be retained to provide construction monitoring and testing services during site grading, foundation, retaining wall, underground utility and road construction to observe subsurface conditions with respect to our engineering recommendations.

6.2 Structural Improvement Design Criteria

The following sections provide design criteria for foundations, seismic design, slabs-on-grade, retaining walls, and pavement sections.

6.2.1 Foundations

Our opinion is that shallow spread foundations are suitable for support of the proposed structures. The following paragraphs discuss foundation design parameters and construction recommendations.

Exterior foundations should be embedded a minimum of 24 inches below the lowest adjacent exterior finish grade for frost protection and confinement. The bottom of interior footings should be at least 12 inches below lowest adjacent finish grade for confinement. Reinforcing steel requirements for foundations should be determined by the project structural engineer.

Foundations founded in competent, undisturbed native soil or compacted fill may be designed using an allowable bearing capacity of 3,500 psf for dead plus live loads. Allowable bearing pressures may be increased by 33 percent for transient loading such as wind or seismic loads.

Resistance to lateral loads (including transient loads) may be provided by frictional resistance between the bottom of concrete foundations and the underlying soil, and by passive soil pressure against the sides of foundations. Lateral resistance derived from passive earth pressure can be modeled as a triangular pressure distribution ranging from 0 psf at the ground surface to a maximum of 350d psf, where d equals the depth of the foundation in feet. A coefficient of friction of 0.4 may be used between poured-in-place concrete foundations and the underlying native soil.

Total settlement of individual foundations will vary depending on the plan dimensions of the foundation and actual structural loading. Based on anticipated foundation dimensions and loads, we estimate that total post-construction settlement of footings designed and constructed in accordance with our recommendations will be on the order of ½-inch. Differential settlement between similarly loaded, adjacent footings is expected to be less than ¼ -inch, provided footings are founded on similar materials (e.g., all on engineered fill, native soil, or rock). Differential settlement between adjacent footings founded on dissimilar materials (e.g., one footing on soil and an adjacent footing on rock) may approach the maximum anticipated total settlement. Settlement of foundations is expected to occur rapidly and should be essentially complete shortly after initial application of loads.

Loose material remaining in footing excavations should be removed to expose firm, unyielding material or compacted to at least 90 percent relative compaction. Footing excavations should be moistened prior to placing concrete to reduce risk of problems caused by wicking of moisture from curing concrete. Holdrege & Kull should observe footing excavations prior to reinforcing steel and concrete placement.

6.2.2 Seismic Design Criteria

In accordance with the 2013 CBC, the seismic design criteria shown in the table below should be used for the project site. The values were obtained for the site using the online US Geological Survey U.S. Seismic Design Maps tool found at http://earthquake.usgs.gov/designmaps/us/application.php. Input values included the site's approximate latitude and longitude obtained from Google Earth, and the Site Class. Site class selection was based on our literature review, our subsurface investigation, our experience in the area, and the site class definitions provided in Chapter 20 of ASCE 7-10.

2013 CBC Seismic Design Parameters		
Description	Value	Reference
Approximate Latitude/Longitude	39.3201 / -120.1494	Google Earth
Site Class	C	Table 20.3-1, ASCE 7-10
Mapped Short Period Spectral Response Acceleration Parameter	S_s = 1.293 g	Figure 1613.3.1(3), 2013 CBC
Mapped 1-Second Period Spectral Response Acceleration Parameter	S_1 = 0.432 g	Figure 1613.3.1(2), 2013 CBC
Short Period Site Coefficient	F_a = 1.0	Table1613.3.3(1), 2013 CBC
1-Second Period Site Coefficient	F_v = 1.368	Table 1613.3.3(2), 2013 CBC
Site Adjusted Short Period Spectral Response Acceleration Parameter	S_{MS} = 1.293 g	Equation 16-37, 2013 CBC
Site Adjusted 1-Second Period Spectral Response Acceleration Parameter	S_{M1} = 0.591 g	Equation 16-38, 2013 CBC
Design Short Period Spectral Response Acceleration Parameter	S_{DS} = 0.862 g	Equation 16-39, 2013 CBC
Design 1-Second Period Spectral Response Acceleration Parameter	S_{D1} = 0.394 g	Equation 16-40, 2013 CBC
Risk Category	II	Table 1604.5, 2013 CBC
Seismic Design Category	D	Tables1613.3.5 (1) & (2) 2013 CBC

6.2.3 Slab-on-Grade Construction

Slabs-on-grade should be a minimum of 4 inches thick. If floor loads higher than 250 psf, intermittent live loads, or vehicle loads are anticipated, the project structural engineer should provide slab thickness and steel reinforcing requirements.

Prior to constructing concrete slabs, the upper 8 inches of slab subgrade should be scarified, uniformly moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 90 percent of the maximum dry density per ASTM D1557. Scarification and recompaction may not be required if floor slabs are placed directly on undisturbed compacted structural fill.

Slabs should be underlain by at least 4 inches of Class 2 aggregate base placed over the prepared subgrade. The aggregate base should be compacted to a minimum of 95 percent of the maximum dry density per ASTM D1557. If a subdrain is installed as described below, slabs may be constructed over the crushed gravel layer provided a moisture barrier will be placed over the gravel.

To reduce the potential for moisture intrusion, the project architect and/or owner should consider constructing a drain beneath concrete slabs on grade that will receive moisture-sensitive floor coverings, or in areas where groundwater is encountered during grading. Subdrains should consist of a minimum of 4-inches of clean crushed gravel placed over native subgrade leveled or sloped at 2 percent towards a 4-inch diameter perforated drain pipe. The drain pipe should be placed with perforations face down in a minimum 12 inch wide gravel filled trench. The depth of the trench may vary depending on cover requirements for the drain pipe and the slope required to drain water from beneath the slab to a properly constructed infiltration gallery or detention basin. A minimum of one pipe should be installed in each area of the slab surrounded by continuous perimeter foundation elements.

In slab-on-grade areas where moisture sensitive floor coverings are proposed, a vapor barrier (e.g. 15 mil Stego® Wrap) should be placed over the base course or gravel subdrain to reduce the migration of moisture vapor through the concrete slab. The Stego® Wrap should be installed in accordance with the manufacturer's instructions. Concrete should be placed directly on the vapor barrier. All slab concrete should have a water-cement ratio of 0.45 or less.

Regardless of the type of vapor barrier used, moisture can wick up through a concrete slab. Excessive moisture transmission through a slab can cause adhesion loss, warping, and peeling of resilient floor coverings, deterioration of adhesive, seam separation, formation of air pockets, mineral deposition beneath flooring, odor, and fungi growth. Slabs can be tested for water transmissivity in areas that are moisture sensitive. Commercial sealants, moisture retarding admixtures, fly ash, and a reduced water-to-cement ratio can be incorporated into the concrete to reduce slab permeability. To further reduce the chance of moisture transmission, a waterproofing consultant should be contacted.

Exterior slabs-on-grade such as sidewalks should be placed on a minimum 6-inch thick compacted aggregate base section to help reduce the potential for frost heave. Deleterious material should be removed from floor slab subgrades prior to concrete placement. For exterior slabs, the native soil should be ripped, moisture conditioned and recompacted to an 8-inch depth.

Concrete slabs impart a relatively small load on the subgrade (approximately 50 psf). Therefore, some vertical movement should be anticipated from possible expansion, freeze-thaw cycles, or differential loading.

6.2.4 Retaining Wall Design Criteria

Retaining walls should be designed to resist lateral earth pressures exerted by retained, compacted backfill plus additional lateral forces (i.e. surcharge loads) that will be applied to walls. The following active and passive pressures are for well drained walls retaining native soil. If import soil is used for fill or backfill, we should review our recommendations. Pressures exerted against retaining walls may be calculated by modeling soil as an equivalent fluid with unit weights presented in the following table.

Table 6.2.4.1 – Equivalent Fluid Unit Weights*

Loading Condition	Retained Cut or Compacted Fill (Level Backfill)	Retained Cut or Compacted Fill (Backfill Slopes up to 2:1, H:V)
Active Pressure (pcf)	30	45
Passive Pressure (pcf)	350	350
At-Rest Pressure (pcf)	45	60
Coefficient of Friction	0.4	0.4

* Equivalent fluid unit weights presented are ultimate values and do not include a factor of safety. Passive pressures provided assume footings are founded in competent native soil or compacted and tested fill.

The values presented in Table 6.2.4.1 assume that the retained soil will not exceed approximately 5 feet in height and that no surcharge loads (e.g., footings, vehicles) are anticipated within a horizontal distance of approximately 3 feet from the face of the wall. If additional surcharge loads are anticipated, we should review the proposed loading configuration to provide loading-specific design criteria. In addition, we can provide retaining wall and rockery wall design criteria for specific loading and backfill configurations, if requested.

The use of the tabulated active pressure unit weight requires that the wall design accommodate sufficient deflection for mobilization of the retained soil to occur. Typically, a wall yield of less than 0.1 percent of the wall height is sufficient to mobilize active conditions in granular soil. If the walls are rigid or restrained to prevent rotation, at-rest conditions should be used for design.

Additional lateral loading on retaining structures due to seismic accelerations may be considered at the designer's option. For this site, we recommend using a design ground acceleration (K_h) of 0.35g with the Mononobe-Okabe/Seed Whitman procedure to evaluate seismic loading on retaining walls.

Compaction equipment should not be used directly adjacent to retaining walls unless the wall is designed or braced to resist the additional lateral forces. If surface loads are closer to the top of the retaining wall than one-half of its height, Holdrege & Kull should review the loads and loading configuration. We should also review details and plans for any proposed wall over 5 feet in height.

Retaining wall backfill should consist of granular material, nearly free of organic debris, with liquid limit of less than 40, a plasticity index less than 15, 100 percent passing the 8-inch sieve, and less than 35 percent passing the No. 200 sieve. Backfill should be uniformly moisture conditioned to within 2 percent of the ASTM D1557 optimum moisture content and compacted with appropriate compaction equipment to at least 90 percent of the maximum dry density per ASTM D1557. If the retaining wall backfill will support foundations or rigid pavements, the backfill should be compacted to at least 95 percent of the maximum dry density per ASTM D1557. We should review and provide specific backfill criteria for all retaining walls over 10 feet in height. Utilities that run through retaining wall backfill should not pass through the wall or other rigid structures without allowance for vertical movement of several inches.

Retaining wall design criteria presented in Table 6.2.4.1 assume that retaining walls are well drained to reduce hydrostatic pressures. Drainage blankets consisting of graded rock drains and geosynthetic blankets should be installed to reduce hydrostatic pressures. Rock drains should consist of a minimum 18 inches of open-graded crushed rock, and placed directly behind the wall, wrapped in non-woven geotextile filter fabric such as Mirafi 140N or approved equivalent. Drains should have a minimum 4-inch diameter, perforated drain pipe placed at the base of the wall, inside the drain rock, with perforations placed down. The pipe should be sloped so that water is directed away from the wall by gravity. A geosynthetic drainage blanket such as Enkadrain^{TM} or equivalent should also be placed against the back of the wall. Backfill must be compacted carefully so that equipment or soil does not tear or crush the drainage blanket.

We recommend that subsurface walls and slabs be treated to resist moisture migration. Moisture retarding material should consist of sheet membrane rubberized asphalt, polymer-modified asphalt, butyl rubber, or other approved material capable of bridging nonstructural cracks, applied in accordance with the manufacturers recommendations. Extra attention should be paid to concrete cold joints between walls and footings. A manufactured water-stop or key should be placed at all cold joints. The project architect or contractor may wish to consult with a waterproofing expert regarding additional options for reducing moisture migration into living areas.

6.2.5 Pavement Design

The existing pavement at the site appears to be performing moderately well. Environmental factors, such as freeze-thaw cycles and thermal cracking will usually govern the life of asphalt concrete (AC) pavements in low traffic areas. Thermal cracking of asphalt pavement allows more water to enter the pavement section, which promotes deterioration and increases maintenance costs. In addition, snow removal activities on site may result in heavy traffic loads. For these reasons, we recommend a minimum driveway/parking area pavement section of 3 inches of AC on 8 inches of aggregate base (AB). The existing pavement may be pulverized in place and used for the 8-inch thick pavement base course recommended above. Pulverized material may result in relatively coarse aggregate and may be difficult to finish grade. However, the aggregate should provide adequate support for asphalt concrete.

The upper 6 inches of native soil should be compacted to at least of 95 percent of the maximum dry density per ASTM D1557 prior to placing aggregate baserock. Aggregate baserock should also be compacted to a minimum of 95 percent. Subgrade and AB dry density should be evaluated by Holdrege & Kull. In addition to field density tests, subgrade should be proof rolled under the observation of Holdrege & Kull prior to baserock placement.

To improve pavement performance and lifespan, we recommend promoting drainage of the pavement subgrade. Drainage can be accomplished through roadway layout and design, subdrains, or v-ditches. A representative of Holdrege & Kull should evaluate pavement subgrade at the time of construction and provide location-specific recommendations for subdrains and/or v-ditches. Typical subdrains consist of a minimum of 4-inches of clean, crushed, compacted, ¾-inch gravel. Pavement subgrade should be graded and prepared such that water drains from beneath pavement section and to a properly designed infiltration or detention basin. Subdrains may be used in conjunction with v-ditches located on one or both sides of the roadway. The v-ditches should be constructed to a depth greater than the proposed pavement and subdrain section. Ditches should be rock-lined or vegetated to help reduce erosion, and convey water to a properly designed infiltration or detention basin. If subgrade soil is relatively free draining, it may be possible to construct v-ditches in lieu of subdrains.

We recommend installing cut-off curbs where paved areas abut landscaped areas to reduce migration of irrigation water into subgrade soil or baserock, promoting asphalt failure. Cut-off curbs should be a minimum of 4-inches wide, and extend through the aggregate base a minimum of 4 inches into subgrade soil.

7. LIMITATIONS

Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in the site area at the time the report was prepared. No warranty, express or implied, is intended.

Our services were performed consistent with our agreement with our client. We are not responsible for the impacts of changes in environmental standards, practices or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client. Reliance on this report by a third party is at the risk of that party.

If changes are made to the nature or design of the project as described in this report, then our conclusions and recommendations presented in the report should be reviewed by Holdrege & Kull to review our conclusions and recommendations. Additional field work and laboratory tests may be required to revise our recommendations. Costs to review project changes, perform additional field work and laboratory testing necessary to modify our recommendations are beyond the scope of services provided for this report. Additional work will be performed only after receipt of an approved scope of services, budget, and written authorization to proceed.

Analyses, conclusions and recommendations presented in this report are based on site conditions as they existed at the time we performed our subsurface exploration. We assumed that subsurface soil conditions encountered at the location of our exploratory test pits are generally representative of subsurface conditions across the project site. Actual subsurface conditions at locations between and beyond our exploratory test pits may differ. If subsurface conditions encountered during construction are different than those described in this report, we should be notified so that we can review and modify our recommendations as needed.

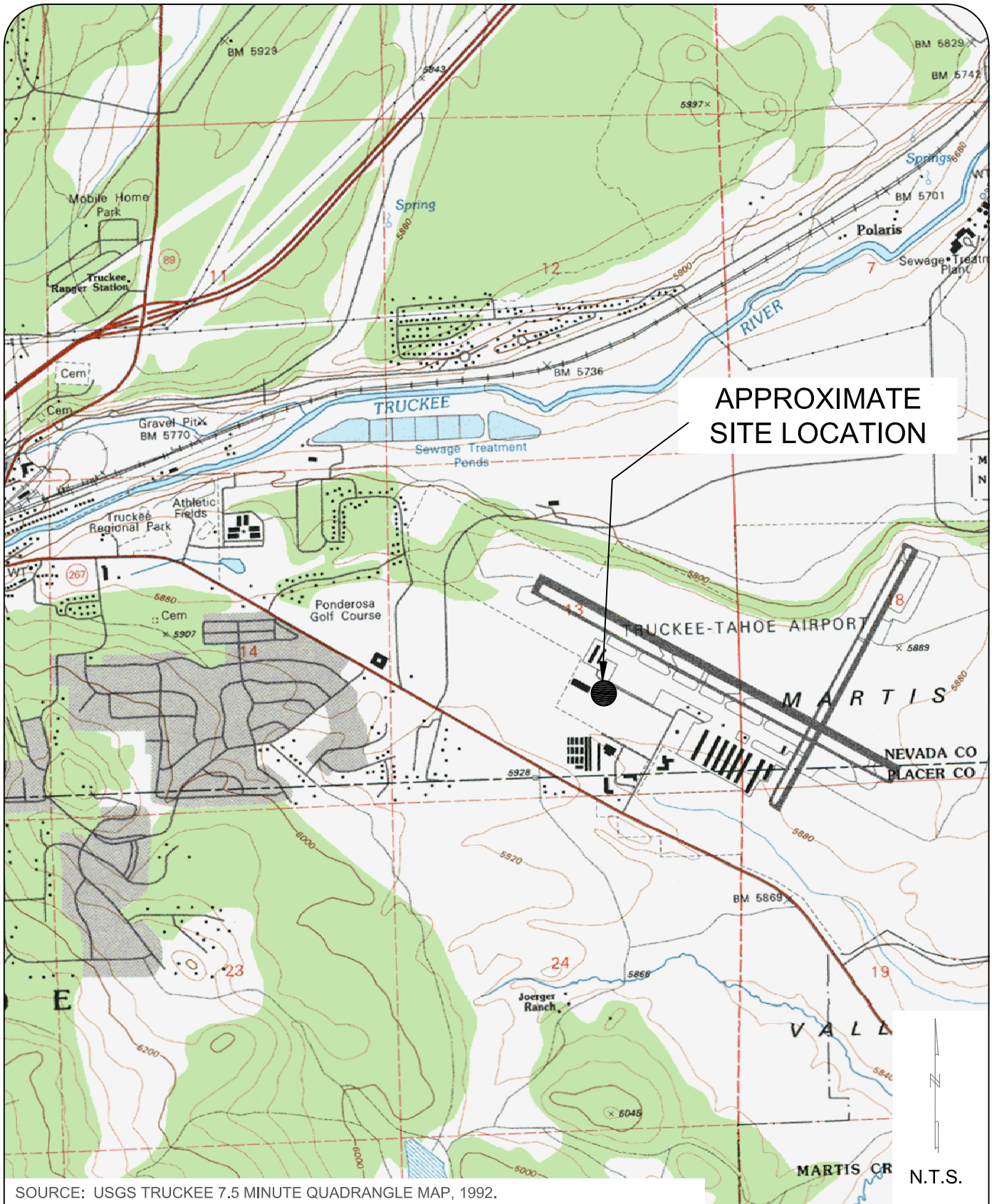
The elevation or depth to groundwater and soil moisture conditions underlying the project site may differ with time and location. The project site map shows approximate exploratory test pit locations as determined by pacing distances from identifiable site features. Therefore, test pit locations should not be relied upon as being exact.

Our scope of services did not include evaluating the project site for the presence of hazardous materials or petroleum products. Although we did not observe evidence of hazardous materials or petroleum products at the time of our field investigation, project personnel should take necessary precautions should hazardous materials be encountered during construction.

The findings of this report are valid as of the present date. Changes in the conditions of the property can occur with the passage of time. These changes may be due to natural processes or works of man, at the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

FIGURES

Figure 1 Site Vicinity Map
Figure 2 Test Pit Location Plan



SOURCE: USGS TRUCKEE 7.5 MINUTE QUADRANGLE MAP, 1992.

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
10775 PIONEER TRAIL
SUITE 213
TRUCKEE, CA 96161
(530) 587-5156

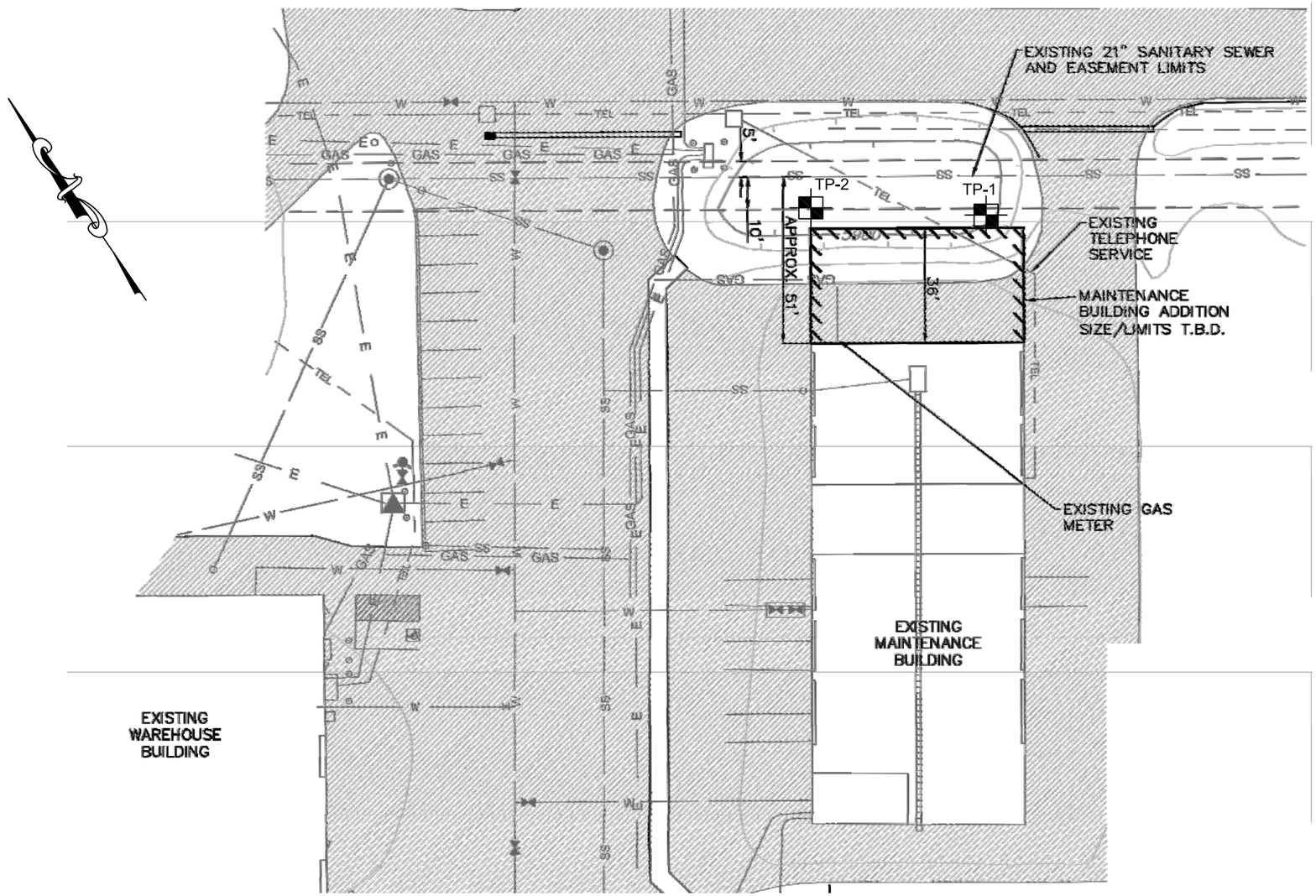
SITE VICINITY MAP

TRUCKEE TAHOE AIRPORT
MAINTENANCE BUILDING ADDITION
TRUCKEE, CALIFORNIA

PROJECT NO.: 41377A-02

DATE: FEBRUARY 2016

FIGURE NO.: 1



LEGEND:

TP-2 APPROXIMATE TEST PIT LOCATION

40 0 20 40

APPROXIMATE SCALE IN FEET

1" = 40'

BASE FROM PRELIMINARY SITE PLAN PREPARED BY ACUMEN ENGINEERING COMPANY, DATED NOVEMBER 9, 2015.

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
10775 PIONEER TRAIL, SUITE 213
TRUCKEE, CA 96161
(530) 587-5156 FAX 587-5196

TEST PIT LOCATION PLAN

TRUCKEE TAHOE AIRPORT MAINTENANCE BUILDING ADDITION

TRUCKEE, CALIFORNIA

DRAWN BY: PJR	CHECKED BY: JKH
PROJECT NO.: 41377A-02	
DATE: FEBRUARY 2016	
FIGURE NO.: 2	

APPENDIX A **Proposal**

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Proposal No. PT15259
November 17, 2015

Acumen Engineering Company
P.O. Box 3497
Truckee, California 96160

Attention: Mr. Bill Quesnel

Reference: ***Truckee Tahoe Airport District Maintenance Building Addition***
Truckee, California

Subject: ***Proposal for Geotechnical Engineering Report***

This letter presents our proposal to prepare a geotechnical engineering report for the proposed addition to an existing Maintenance Building located at the Truckee Tahoe Airport in Truckee, California. The purpose of our services will be to explore and evaluate subsurface conditions at the project site, and to develop geotechnical engineering recommendations for project design and construction. Holdrege & Kull will provide value engineering and site specific design recommendations to help reduce construction costs for your project. We have a reputation for responsive, innovative, yet practical approaches to geotechnical problems. Included in this proposal are a brief summary of our understanding of the project, the scope of services we can provide, and an estimate of our fees.

PROJECT DESCRIPTION

This proposal is based on communications with you and our previous experience in the project area. The site contains an existing Maintenance Building. The proposed project will involve constructing an addition to the northeast side of the existing structure. The proposed addition will be a single-story, pre-fabricated, steel-frame structure with a mezzanine and slab-on-grade floors. Structural loads were not available, and were assumed for purposes of this proposal. Estimated vertical structural loads are not expected to exceed approximately 200 kips at isolated columns and 6 kips per linear foot along continuous wall foundations for long-term loading conditions. Cuts and fills for building pad construction are anticipated to be typically about 1 to 2 feet. Appurtenant construction will likely include new underground utilities.

ANTICIPATED CONDITIONS

In preparation of this proposal, we reviewed geologic maps and reports in our files regarding subsurface conditions in the project vicinity. Based on this

information and our experience in the site area, we anticipate that subsurface soil conditions will consist of medium dense to very dense silty sand with gravel to poorly graded sand with silt and gravel and cobbles.

We anticipate that perched groundwater or saturated soils may be seasonally present at relatively shallow depths. We anticipate that the site can be accessed by conventional vehicles and excavating equipment.

SCOPE OF SERVICES

Review of Available Literature and Underground Utility Clearance

Prior to our subsurface exploration, we will review regional geologic maps and reports in our files from other nearby sites. In addition, we will mark the site for Underground Service Alert (USA) and contact this agency for underground utility clearance prior to our subsurface exploration. Our field exploration locations will be selected based on site access and the anticipated project layout.

Field Exploration

We propose to explore the subsurface conditions at the site by excavating 2 test pits to depths up to approximately 10 feet below the existing ground surface or refusal. The test pits will be excavated using equipment and an operator supplied by the Truckee Tahoe Airport District. The test pits will be visually logged by a field representative who will obtain bulk soil samples for classification and laboratory testing. Upon completion, the test pits will be loosely backfilled with excavated soil.

Laboratory Testing

The purpose of laboratory testing is to evaluate the physical and engineering properties of the soil samples collected in the field. We anticipate the laboratory testing program will consist of tests for soil classification (gradations and plasticity), and expansion potential.

Analysis and Report

Based on the results of our field exploration and laboratory testing, we will provide our opinions and recommendations regarding the following:

- General soil and groundwater conditions at the project site, with emphasis on how the conditions are expected to affect the proposed construction;
- Discussion of special geotechnical engineering constraints such as existing fill, highly expansive or compressible soil, near-surface groundwater, liquefaction potential, potential secondary seismic hazards, and/or near-surface rock;

- Recommendations for earthwork construction, including site preparation recommendations, a discussion of reuse of existing near surface soil as structural fill, and a discussion of remedial earthwork recommendations, if warranted;
- Recommendations for temporary excavations, construction dewatering, and trench backfill;
- Recommendations for permanent cut and fill slopes;
- Surface and subsurface drainage recommendations;
- Recommendations for conventional shallow spread foundation design including soil bearing values, minimum footing depth, resistance to lateral loads and estimated settlements, and California Building Code site class and seismic coefficients for use in structural design;
- Lateral earth pressures and drainage recommendations for short retaining structures;
- Subgrade preparation for slab-on-grade concrete; and,
- Asphalt concrete and paving stone pavement recommendations.

We will present our opinions and recommendations in a written report complete with logs of our test pits and laboratory test results.

SCHEDULE AND FEES

We have tentatively scheduled our subsurface exploration to occur on November 20, 2015, depending on weather conditions. If weather, access, or site conditions restrict our field operations, we may need to revise our scope of services and fee estimate. We anticipate submitting our final written report within two to three weeks after completing our subsurface exploration. If requested, we can provide preliminary verbal information with respect to our anticipated conclusions and recommendations prior to completion of our final report.

We can provide the scope of services as described above for a lump sum fee of [redacted]. This cost does not include the excavation equipment and operator we plan to use for our subsurface exploration. Billing will be monthly on a percent complete basis. Additional services beyond the scope of this proposal, performed at the client's request, will be billed on a time and materials basis using the fee schedule applicable at the time the services are provided.

LIMITATIONS

Prior to initiating our subsurface exploration, all site utilities and utility easements on the site must be accurately located in the field, on a scaled map, or both. This information must be made available to Holdrege & Kull by the client before beginning our subsurface exploration. Our fee is not adequate to compensate for both the performance of the services and the assumption of risk of damage to such structures. Holdrege & Kull will not accept responsibility for damage to

existing utilities not accurately located in the manner described above. Services rendered by Holdrege & Kull to repair them will be billed at cost.

Holdrege & Kull will perform its services in a manner consistent with the standard of care and skill ordinarily exercised by members of the profession practicing under similar conditions in the geographic vicinity and at the time the services will be performed. No warranty or guarantee, express or implied, is part of the services offered by this proposal.

CLOSING

Enclosed with this proposal is our firm's Agreement for Geotechnical Engineering Services. Please sign and return one copy of the attached Agreement for Geotechnical Engineering Services to this office as our authorization to proceed. This proposal is deemed to be incorporated into and made part of the Agreement for Geotechnical Engineering Services.

We appreciate the opportunity to submit this proposal and look forward to providing our services to you on this project. If you have any questions or need additional information, please contact the undersigned.

Sincerely,

Holdrege & Kull

Pamela J. Raynak, PG
Senior Geologist

John K. Hudson, PE, CEG
Principal

Enclosure: Agreement for Geotechnical Engineering Services

APPENDIX B **Important Information About Your Geotechnical Engineering Report**
(Included with permission of ASFE, Copyright 1998)

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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APPENDIX C **Test Pit Logs**

TEST PIT NO. 1

PROJECT NO.	PROJECT NAME	APPROXIMATE ELEVATION	DATE	PAGE
41377A-02	TRUCKEE TAHOE AIRPORT MAINTENANCE BUILDING ADDITION	5900 FEET (APPROX.)	11/20/2015	1 OF 1

EXCAVATING METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
CATERPILLAR 416 BACKHOE W/12" BKT.	BULK	NO	NO

SAMPLE NO.	PERCENT PASSING #200 SIEVE	POCKET PENETRO-METER (TSF)	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
			1	SM	2 INCHES DARK BROWN SILTY SAND (SM); MOIST, LOOSE, WITH ORGANICS (TOPSOIL).
1-1	20	--	2	SM	BROWN SILTY SAND WITH GRAVEL (SM); MOIST, LOOSE TO MEDIUM DENSE, FINE TO MEDIUM SAND, WITH FINE TO COARSE GRAVEL, ESTIMATED 20% TO 30% FINES.
			3		
1-2	10	--	4	SM	DARK BROWN SILTY SAND WITH GRAVEL (SM); MOIST, MEDIUM DENSE, WEAKLY TO MODERATELY CEMENTED, FINE SAND, FINE TO COARSE GRAVEL, WITH COBBLES TO 10 INCHES DIAMETER, ESTIMATED 10% TO 20% FINES.
			5		
			6		ESSENTIAL REFUSAL ON COBBLES AT 6 FEET. BACKHOE EQUIPPED WITH SMALL DITCH BUCKET.
			7		
			8		
			9		
			10		
			11		
			12		
			13		
			14		
			15		
			16		
			17		
			18		
			19		
			20		

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TEST PIT NO. 2

PROJECT NO.	PROJECT NAME	APPROXIMATE ELEVATION	DATE	PAGE
41377A-02	TRUCKEE TAHOE AIRPORT MAINTENANCE BUILDING ADDITION	5900 FEET (APPROX.)	11/20/2015	1 OF 1

EXCAVATING METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
CATERPILLAR 416 BACKHOE W/12" BKT.	BULK	NO	NO

SAMPLE NO.	PERCENT PASSING #200 SIEVE	POCKET PENETRO-METER (TSF)	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
			0	SM	2 TO 3 INCHES DARK BROWN SILTY SAND (SM); MOIST, LOOSE, WITH ORGANICS (TOPSOIL).
2-1	--	--	2	SM	DARK BROWN SILTY SAND WITH GRAVEL (SM); MOIST, LOOSE TO MEDIUM DENSE, FINE TO MEDIUM SAND, FINE TO COARSE GRAVEL, WITH SOME COBBLES TO 4 INCHES DIAMETER, ESTIMATED 20% TO 30% FINES.
2-2	--	--	3	SM	DARK BROWN SILTY SAND WITH GRAVEL (SM); MOIST, MEDIUM DENSE, WEAKLY TO MODERATELY CEMENTED, FINE TO MEDIUM SAND, FINE TO COARSE GRAVEL, WITH TRACE COBBLES TO 10 INCHES DIAMETER, ESTIMATED 10% TO 20% FINES.
			7		INCREASING COBBLES AT 7 FEET.
			9		TEST PIT TERMINATED AT 9 FEET.

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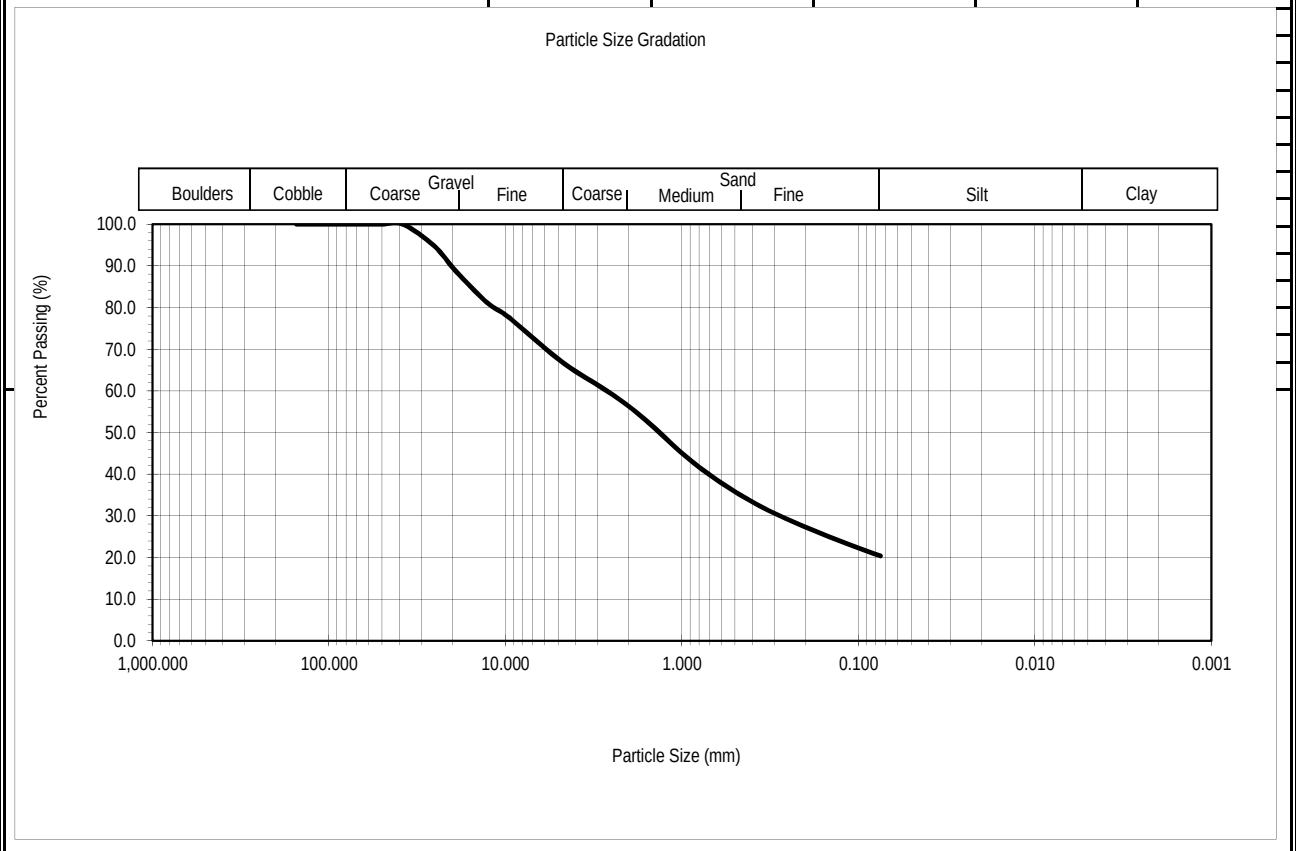
APPENDIX D Laboratory Test Results

Particle Size Distribution

ASTM D422

Project No.: **41377A-02** Project Name: **TTAD Maint. Bldg. Addition** Date: **11/20/2015**
Sample No.: **1-1** Boring/Trench: **TP-1** Depth, (ft.): **1.5** Tested By: **SJS**
Description: **Brown (7.5YR 4/4) Silty Sand with Gravel (SM)** Checked By: **MLH**
Sample Location: Lab. No.: **15-15-545**

Sieve Size	Particle Diameter		Dry Weight on Sieve			Percent
	Inches	Millimeter	Retained On Sieve	Accumulated On Sieve	Passing Sieve	Passing
(U.S. Standard)	(in.)	(mm)	(gm)	(gm)	(gm)	(%)
6 Inch	6.0000	152.4	0.00	0.0	3,088.1	100.0
3 Inch	3.0000	76.2	0.00	0.0	3,088.1	100.0
2 Inch	2.0000	50.8	0.00	0.0	3,088.1	100.0
1.5 Inch	1.5000	38.1	0.00	0.0	3,088.1	100.0
1.0 Inch	1.0000	25.4	159.23	159.2	2,928.9	94.8
3/4 Inch	0.7500	19.1	189.26	348.5	2,739.6	88.7
1/2 Inch	0.5000	12.7	233.01	581.5	2,506.6	81.2
3/8 Inch	0.3750	9.5	110.45	692.0	2,396.2	77.6
#4	0.1870	4.7500	331.05	1,023.0	2,065.1	66.9
#10	0.0787	2.0000	325.42	1,348.4	1,739.7	56.3
#20	0.0335	0.8500	424.76	1,773.2	1,314.9	42.6
#40	0.0167	0.4250	265.24	2,038.4	1,049.7	34.0
#60	0.0098	0.2500	150.45	2,188.9	899.3	29.1
#100	0.0059	0.1500	122.29	2,311.2	777.0	25.2
#200	0.0030	0.0750	148.38	2,459.5	628.6	20.4



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Atterberg Indices

ASTM D4318

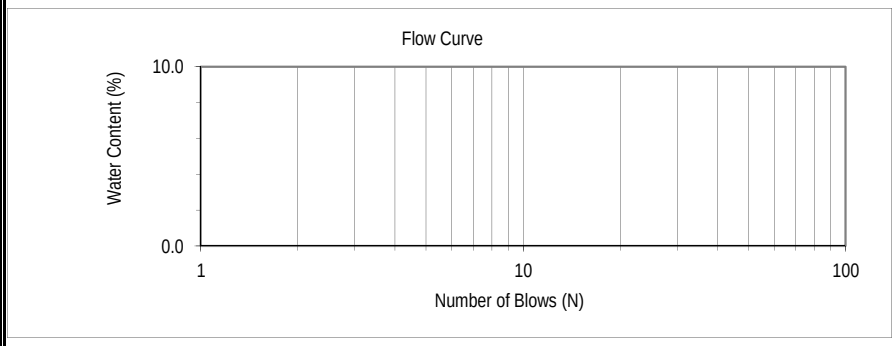
DSA File #:
DSA Appl #:

Project No.:	**41377A-02**	Project Name:	**TTAD Maint. Bldg Add**	Date:	**11/20/2015**
Sample No.:	**TP-1**	Boring/Trench:	**1-1.** Depth, (ft.): **1.5**	Tested By:	**MLH**
Description:	**Brown (7.5YR 4/4) Silty Sand with Gravel (SM)**			Checked By:	**MLH**
Sample Location:				Lab. No.:	**15-15-545**

Estimated % of Sample Retained on No. 40 Sieve: 50 Sample Air Dried: yes

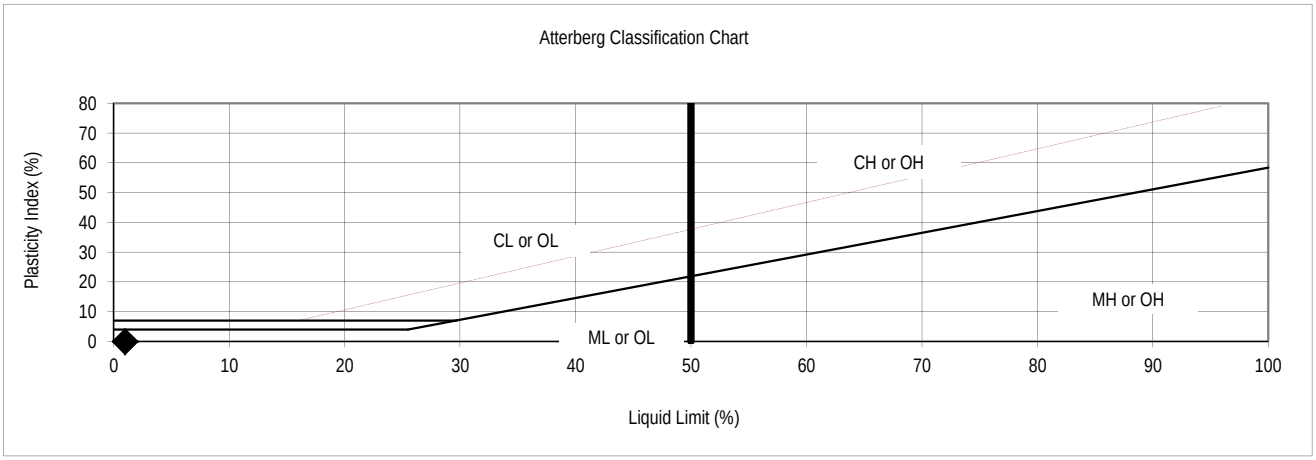
Test Method A or B: A

LIQUID LIMIT:						PLASTIC LIMIT:		
Sample No.:	1	2	3	4	5	1	2	3
Pan ID:	5	4	3			LL	LC	
Wt. Pan (gr)	12.30	12.50	12.55			11.22	11.35	
Wt. Wet Soil + Pan (gr)								
Wt. Dry Soil + Pan (gr)								
Wt. Water (gr)	0.00	0.00	0.00			0.00	0.00	
Wt. Dry Soil (gr)	-12.30	-12.50	-12.55			-11.22	-11.35	
Water Content (%)	0.0	0.0	0.0			0.0	0.0	
Number of Blows, N								
LIQUID LIMIT =	NP					PLASTIC LIMIT =	NP	



Plasticity Index = NP

Group Symbol = ML



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Expansion Index/Swell

ASTM D4829

DSA File #:
DSA Appl #:

Project No.:	41377A-02	Project Name:	TTAD Maint. Bldg. Addition	Date:	1/0/1900
Sample No.:	TP-1	Boring/Trench No.:	1-1	Depth (ft.) 1.5	Tested By: MLH
Soil Description:	Brown (7.5YR 4/4) Silty Sand with Gravel (SM)				Checked By: MLH
Estimated % of sample retained on #4:		Notes:			Lab. No.: 15-15-545

Specimen Type:	Undisturbed:		Disturbed:		Remolded to:		ASTM Guidelines	
Tube Dia. (Inch) =			Ring Dia. (Inch) =	4	Ring Height (Inch) =	1.00		

FIELD DATA Tube Sample Moisture & Density			LAB DATA		Test wt. Initial	144 Final	Test wt. Initial	Final	Test wt. Initial	Final
Tare Tube Number			Tare Number		B40					
Tare Weight	(gr)		Tare Ring Weight	(gr)	200.62	0.00				
Wet Soil + Tare	(gr)	0.00	Tare Pan Weight	(gr)	0.00	273.66				
Dry Soil + Tare	(gr)		Wet Soil + Tare	(gr)	547.59	651.26				
Weight of Water	(gr)	0.00	Dry Soil + Tare	(gr)	499.14	572.18	0.00		0.00	
Dry Soil Weight	(gr)	0.00	Weight of Water	(gr)	48.45	79.08	0.00	0.00	0.00	0.00
Moisture Content	(%)	0.00	Dry Soil Weight	(gr)	298.52	298.52	0.00	0.00	0.00	0.00
Soil Height	(In.)		Moisture Content	(%)	16.23	26.49	0.00	0.00	0.00	0.00
Wet Unit Weight	(pcf)		Wet Unit Weight	(pcf)	105.20	114.52				
Dry Unit Weight	(pcf)		Dry Unit Weight	(pcf)	90.51	90.54				
			Sample Height	(Inches)	1.00	1.000				
Specific Gravity		2.7	Percent Saturation		50.87	83.08				

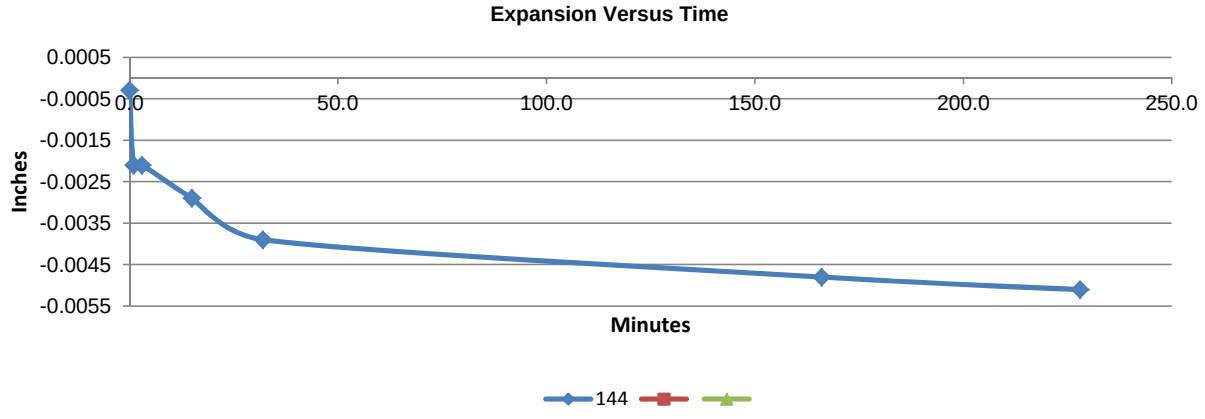
Expansion Index Number

Surcharge (psf)	Uncorrected	Corrected to 50% Saturation
Test wt. 144	0	0
Test wt.		
Test wt.		

Elapsed Time (m:s)	Change in Height (Inches)	Elapsed Time (m:s)	Change in Height (Inches)	Elapsed Time (m:s)	Change in Height (Inches)
0.0	-0.0003				
1.0	-0.0021				
3.0	-0.0021				
15.0	-0.0029				
32.0	-0.0039				
166.0	-0.0048				
228.0	-0.0051				

Expansion Index Values and Descriptions

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High



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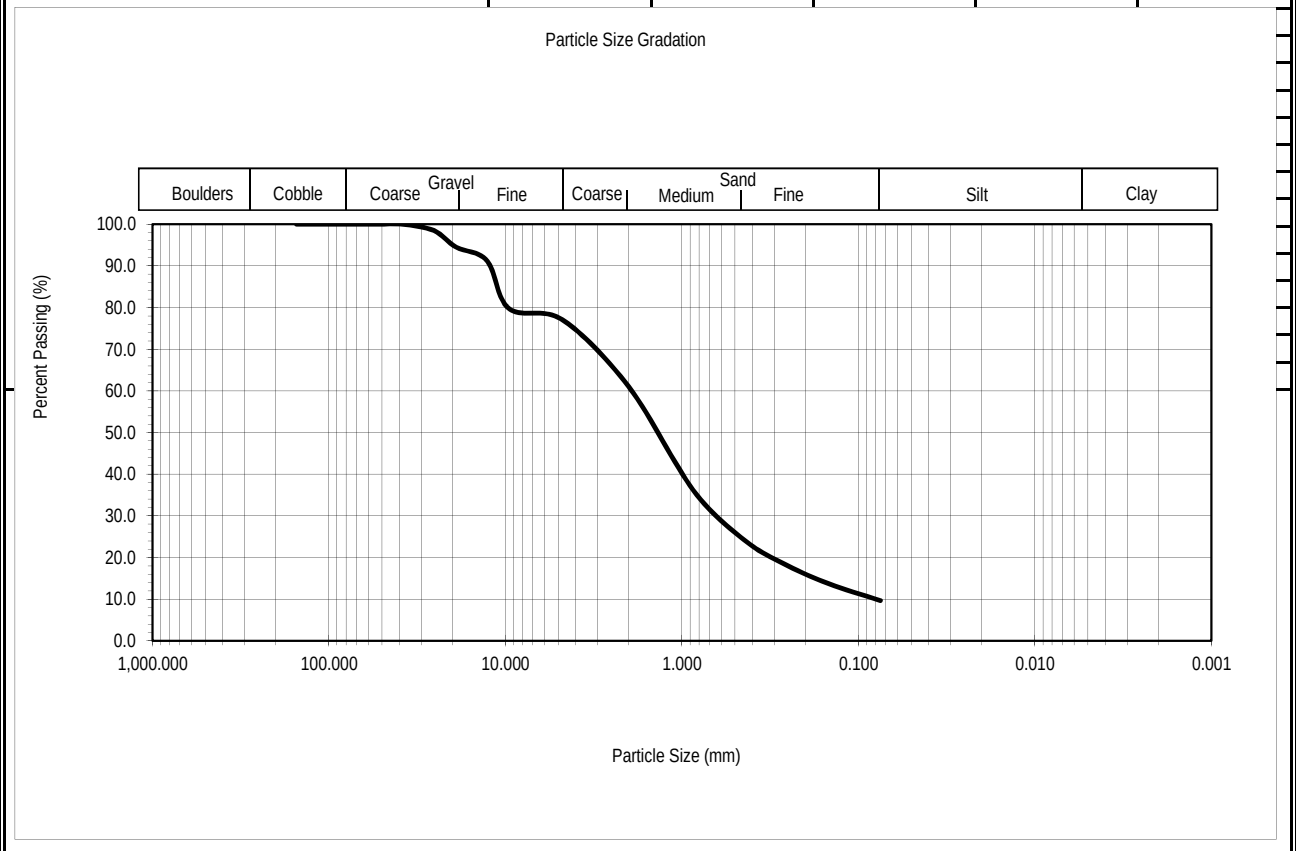
Particle Size Distribution

ASTM D422

Project No.: **41377A-02** Project Name: **TTAD Maint. Bldg. Addition** Date: **11/20/2015**
Sample No.: **1-2** Boring/Trench: **TP-1** Depth, (ft.): **3.5'** Tested By: **SJS**
Description: **Dark Brown (7.5YR 3/4) Silty Sand with Gravel (SM)** Checked By: **MLH**
Sample Location: Lab. No.: **15-15-545**

Sieve Size	Particle Diameter		Dry Weight on Sieve			Percent
	Inches	Millimeter	Retained On Sieve	Accumulated On Sieve	Passing Sieve	Passing
(U.S. Standard)	(in.)	(mm)	(gm)	(gm)	(gm)	(%)
6 Inch	6.0000	152.4	0.00	0.0	3,525.5	100.0
3 Inch	3.0000	76.2	0.00	0.0	3,525.5	100.0
2 Inch	2.0000	50.8	0.00	0.0	3,525.5	100.0
1.5 Inch	1.5000	38.1	0.00	0.0	3,525.5	100.0
1.0 Inch	1.0000	25.4	53.74	53.7	3,471.7	98.5
3/4 Inch	0.7500	19.1	139.53	193.3	3,332.2	94.5
1/2 Inch	0.5000	12.7	115.79	309.1	3,216.4	91.2
3/8 Inch	0.3750	9.5	405.53	714.6	2,810.9	79.7
#4	0.1870	4.7500	94.34	808.9	2,716.6	77.1
#10	0.0787	2.0000	566.92	1,375.8	2,149.6	61.0
#20	0.0335	0.8500	886.44	2,262.3	1,263.2	35.8
#40	0.0167	0.4250	429.01	2,691.3	834.2	23.7
#60	0.0098	0.2500	199.95	2,891.3	634.2	18.0
#100	0.0059	0.1500	146.48	3,037.7	487.7	13.8
#200	0.0030	0.0750	147.99	3,185.7	339.8	9.6



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